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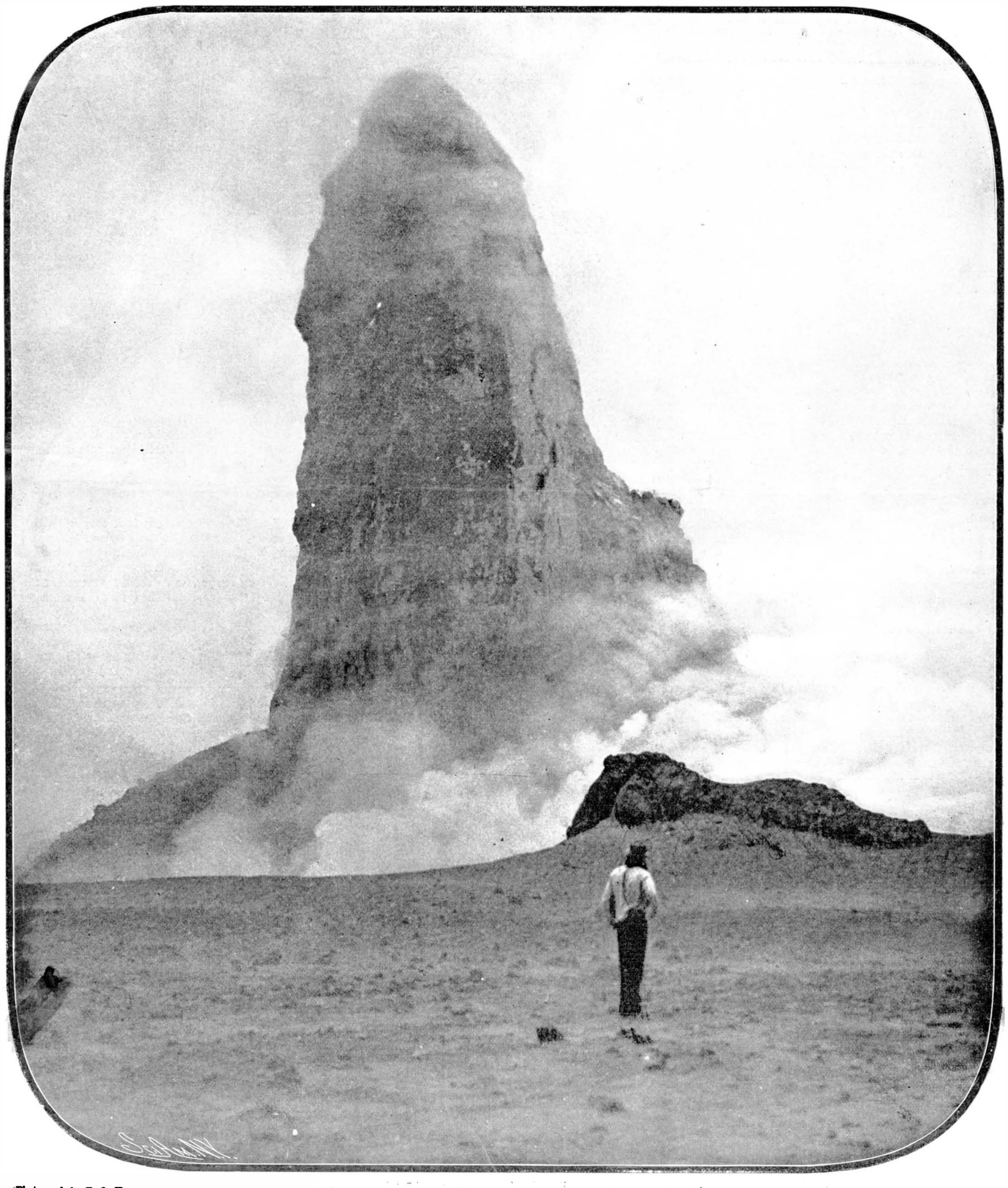

Photograph by E. O. Hovey.

THE OBELISK OF MONT PELE.

A Spine Was Forced Up Out of the Volcano to a Height of 5,000 Feet Above the Sea Level.—[See page 407.]

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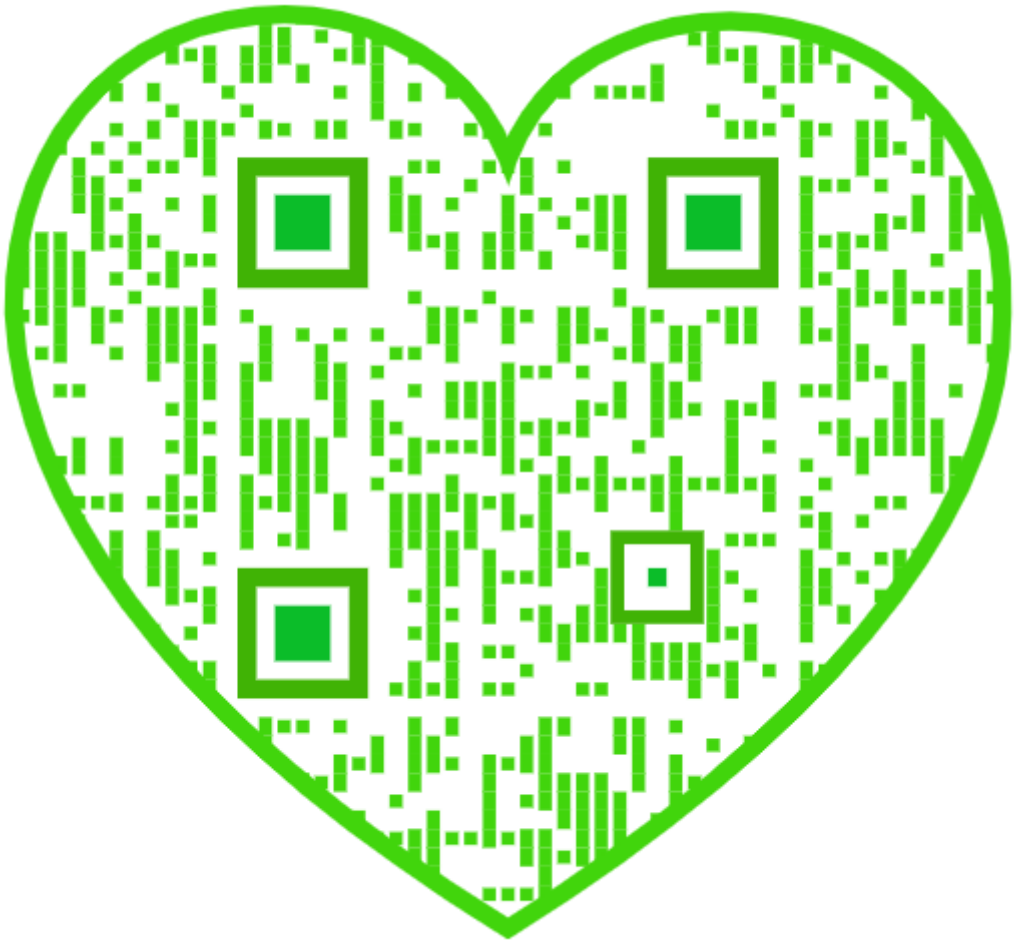

SCIENTIFIC AMERICAN

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NEW YORK, SATURDAY, DECEMBER 5, 1903.

The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

STILL ANOTHER RADIUM PUZZLE.

What is becoming of our science of chemistry? Our century-old atomic conceptions have received a rude shock; the law of the conservation of energy, to which everything in this universe was supposed to be subservient, is attacked; and now we seem to be reverting to the dream of the medieval alchemist—actually thinking of the transmutation of metals.

This, at least, is what we have come to, after the announcement made by Sir William Ramsay that radium apparently changes to helium. When he compares the resultant product of radium with helium, Sir William Ramsay is sure of his ground; for in conjunction with Lord Rayleigh he carried on a series of classic experiments which ended in the discovery of argon and helium—a discovery which deserves to be considered one of the most noteworthy achievements in chemical physics of the nineteenth century. Sir William Ramsay caught the heavy gas which radium emanates, a gas so evanescent that it disappears after a time; he found that gradually its spectrum, entirely different from any hitherto recorded, displayed the characteristic yellow line of helium. Day by day the helium line grew brighter. In a word, one element seemed to have changed to another. It is quite necessary to know how fast radium is turned into helium. As yet little that is definite has been furnished. If nothing else occurs but the changing of radium into helium, then, Prof. Ramsay figures, it will take 2,000,000 years to dissolve the gas.

Are we not perhaps on the verge of some great generalization, which will ultimately prove that just as we have many kinds of forces, all manifestations of one great force, so we may have seventy-odd elements, hitherto regarded as simple forms of matter distinct from each other, but in reality mere manifestations of but one matter? This strange, newly-discovered phenomenon certainly tends to show that one element may be changed into another. "What is this?" asked Sir William Ramsay, "but an actual case of that transmutation of one element into another in which the ancient alchemists believed when they painfully sought to change lead into gold and incidentally founded the modern science of chemistry?"

Clearly, there are more things between heaven and earth than are dreamed of in our chemical philosophy.

WIND BRACING DURING ERECTION.

The concurrence of several fatal accidents, due to the overturning by wind storms of partly-erected steel structural work in bridges and buildings, calls for a word of warning on this too-little-understood and too-much-neglected subject. We had occasion to draw attention in these columns, a few years ago, to the complete collapse of the steel structural work of a whole terminal shed on one of the new steamship piers in this city, the accident being due entirely to the carelessness or oversight of the superintendent of erection, in not placing sufficient temporary wind bracing. To the same cause must be attributed the fall of a traveler on the new Wabash Railroad bridge at Pittsburg, in which several lives were lost; the fatal accident on the Jersey Central bridge over Newark Bay; the fall of a considerable section of structural work on a New York warehouse; and the collapse of the steel work of a mill that was under construction at Chicago. The best modern construction in tall buildings makes special provision, in the way either of knee bracing or lateral ties and struts, for wind pressure; but there are scores of buildings put up, in which the skeleton frame has nothing to offer in resistance to wind pressure more than the relatively insignificant strength of the bolts and rivets with which the columns and beams are fastened together. To guard against collapse of such buildings during erection, it is customary to put in temporary ties of wire cable; and were this precaution always followed, and did the tying up advance as fast as the erection of the structural work, fatal accidents would never occur. As it is, the desire to make a record on the part of the erecting gang, or the carelessness or parsimony of the construction company, too often permits the erection to be carried to dangerous lengths before wind bracing is put in. If the weather is settled and no heavy blow should occur before a bridge is slung or the masonry of a building built in place, there will be no disaster; but too often the contractor is caught napping by a summer squall or winter gale—and another list of fatalities has to be recorded. It would be well for building inspectors and railroad engineers to exercise a more searching supervision of this most impotant feature in steel construction.

THE SIXTEEN-KNOT SAILING YACHT.

As an aftermath of the recent yachting season, there are two events which have served to stimulate the waning interest of yachtsmen in the closing months of the year; one is the offer of Emperor William of a cup for an ocean race from Sandy Hook to the eastward across the Atlantic Ocean, and the other is the remarkable speed shown by the latest of the large auxiliary sailing yachts, which are gaining such great popularity. We refer to the trial trip of the three-masted auxiliary schooner yacht "Atlantic," of which we gave an illustrated description in a special issue of some twelve months ago. This fine vessel, which measures 135 feet on the water line and 185 feet on deck, has been built for the express purpose of deep-sea cruising, and to this end she has been given the very moderate draft for a yacht of this size of 15 feet, and has been furnished with steam motive power which, on her recent trials, proved capable of driving the boat at a speed of 10½ knots an hour under steam alone. In order to try out her rigging, spars, sails, and machinery before the finishing touches were put on, the yacht was recently taken out for a cruise on Long Island Sound, during which she showed remarkable speed, and proved that the claim of her designer that she would, under favorable conditions, be capable of making 16 knots an hour, was well founded. The run in question was made between New London and Newport under sail alone. The yacht, after being delayed in harbor some little time because the wind outside was too severe for a sail-stretching spin, weighed anchor at New London, at 7:45 in the morning, to find when she was outside that the wind was still blowing at 35 miles an hour, with a strength of 40 miles in the puffs. As the wind was abeam, and the conditions favorable for a rapid run, it was decided not to return, but to push through under lower sails only; and anchor was dropped at Brenton's Cove, Newport, at 10:50 the same morning. The "Atlantic" thus covered the distance of 43 knots, from anchorage to anchorage, in three hours and five minutes. The sailing time from Race Rock to Watch Hill, a distance of 9⅛ knots, was exactly thirty-one minutes, which is equivalent to a speed of 18 knots per hour. After making corrections for a two-knot tide in the yacht's favor, she was found to have been making 16 knots an hour, an estimate that agreed very well with the ship's log, according to which she was making 16¼ knots. The tidal conditions, which favored the yacht at the start, were against it during the latter part of the run; and the calculated rate of speed, after making corrections, works out for 37 knots of the course at a trifle over 15 knots an hour.

AN ELECTROMAGNETIC THEORY OF THE AURORA BOREALIS.

In a paper previously read before the French Academy of Sciences, C. H. Nordmann showed by means of theoretical considerations that the sun must emit Hertzian waves, the intensity of which is a maximum in the regions, and at times, of greatest solar activity. From this proposition an explanation of the solar corona and its peculiarities as well as of the spectra of comets was derived. In a recent note presented to the Academy, the author tries to show that the same explanation would elucidate the nature of the aurora borealis, as well as the origin of the oscillations and disturbances of terrestial magnetism. Previous investigations have shown a close connection between the spectrum of the aurora borealis and that of the light surrounding the cathode of a tube containing oxygen and nitrogen; it is hence inferred that the aurora borealis is a cathodical phenomenon occurring in the upper exhausted atmosphere. Some special properties of the aurora borealis are explained by the well-known property of cathode rays to orientate themselves along the lines of force of a magnetic field. As regards the only difficulty left by the explication, viz., the origin of the cathodic phenomena giving rise to the aurora borealis, the author is able to resolve this question by means of the above proposition.

Tubes containing sufficiently exhausted gases will, as shown by Ebert and Wiedemann's work, become illuminated under the influence of Hertzian waves, the luminous phenomena thus produced being accurately identical with the cathode phenomena of Geissler tubes. The author therefore thinks auroræ boreales are caused by cathodical phenomena produced in the atmosphere under the action of the Hertzian wave emanating from the sun, according to the well-known property of these waves.

On this explanation, the different periods of the auroræ boreales will easily be accounted for; the fact that the greatest frequency of the auroræ coincides with the greatest frequency of sun spots is due to the greater intensity exhibited by the Hertzian wave given off from the sun during the maximum of sun spots. The undecennial period of the auroræ seems to correspond with the period of synodical rotation of the sun; this is accounted for by the fact that the regions of maximum activity of the sun performing a complete rotation in about 26 days, the aurora borealis must of necessity possess an identical period. The diurnal period of the phenomenon is equally explained by this theory: though the maximum production should correspond with the maximum of solar radiation in a given point, i. e., to the passage of the sun through the meridian, the apparent maximum of the auroræ cannot be observed until in the early hours of the evening, in accordance with experimental facts, as the brilliancy of daylight at the instant of the real maximum will hide the phenomenon.

The oscillations of the magnetic needle, as is well known, exhibit an undecennial period, closely corresponding to the period of sun spots, like that of aurora borealis. It thus seems as though the variation of terrestrial magnetism should be due to the same cause as auroræ boreales. On the other hand, it is generally presumed that the intensity of terrestrial magnetism and the variations of this intensity are in close connection with the general electric current of atmosphere, produced mainly in the upper exhausted layers of atmosphere, being relatively conductive, under the influence of the unipolar induction of vaporization. Prof. Righi has finally shown the conductivity of an exhausted gas tube to be notably augmented under the influence of Hertzian waves, the tube thus behaving like a coherer. Now the theory of the author will readily account for the undecennial period of terrestrial magnetism; at the time of the maximum of the spots, the more intense Hertzian waves of the sun will give rise to a relatively high diminution in the resistance of the upper atmosphere, resulting in an increase in the intensity of the electric currents of atmosphere, and accordingly in an increase in the intensity of terrestrial magnetism.

The accidental and instantaneous production of auroræ boreales, as well as the variations in the intensity of terrestrial magnetism, may equally be explained on the theory of the author. Many examples are known of magnetic thunder storms attended by auroræ boreales and coinciding with a violent disturbance of a solar spot, as detected by means of the spectroscope. The best instance for the truth of this theory is, however, derived from the fact observed by Young, as far back as 1883, that any considerable disturbance of the solar surface will be transmitted to our terrestrial magnetism with the speed of light. Now this is just the velocity of Hertzian waves.

ARSENIC IN HENS' EGGS.

Since M. Armand Gauthier established the fact that arsenic forms one of the elements of living organisms, the attention of scientists has been directed toward this question. Among the new researches are those of M. Gabriel Bertrand, and in a paper lately presented to the Academie des Sciences he brings out the following facts: Following his previous work upon the presence of arsenic in the organism, he thinks it logical to admit that this element, like sulphur, carbon, and phosphorus, is a constant element in the living cell. Instead of being localized in certain tissues, as Gauthier supposes, it exists, on the contrary, in all tissues. If this conclusion is true, and if arsenic is an element which is necessary to maintain existence, it should be found in the organism at all periods of life, in the cells of the embryo as well as those of the adult. It should therefore be found in the bird's egg, where the embryo is obliged to accomplish all its development without taking from the outside the smallest part of the arsenic which is needed. Accordingly he looked for arsenic in the hen's egg, and succeeded in finding it, of course in very minute quantities. The eggs were obtained from chickens raised at Paris in an inclosed space and fed since they were hatched upon wheat and *debris* of vegetables. Four parts of the egg were observed separately—the shell, the shell membrane, white, and yolk. The matter was first dried and then attacked by a mixture of nitric and sulphuric acids, which were perfectly pure and did not show a trace of arsenic. To detect the arsenic he employed the usual method of projecting a hydrogen flame against a porcelain plate, and found that all the parts of the egg contained appreciable quantities of the element, but the yolk is by far the richest. Of 1-200th milligramme which he finds on an average in a single egg, one-half or two-thirds is contained in the yolk.

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The white has a much less proportion. In spite of its small weight, the membrane contains about the same quantity and sometimes more than the white. With certain eggs it was sufficient to treat 0.15 gramme of membrane (the amount contained in one egg) to obtain a clear arsenic ring. These results, which differ from those which have been obtained hitherto, have only been made possible by an especially sensitive method which he uses. They confirm the existence and the probable rôle of arsenic in all living cells, and scientists may be confident in drawing the conclusions which follow from such an important fact.

THE HEAVENS IN DECEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

The most interesting event of the past month, from the standpoint of the amateur astronomer, has undoubtedly been the appearance of two large groups of sunspots.

The first of these, which is situated some distance north of the sun's equator, must have originated about the end of September, on the far side of the sun. On October 4 the sun's rotation carried it into sight, and it was a conspicuous object, visible even to the naked eye, until it disappeared behind the western limb two weeks later. On October 31 it came round again, and on November 3 and 4 it was followed by another new group of spots, situated in the sun's southern hemisphere.

At the time of writing the first group consists of two large spots, about 30,000 and 20,000 miles in diameter, and about 80,000 miles apart, with a few smaller companions. The second group, though containing no such large spots, is more extensive, forming an irregular line fully 200,000 miles long.

It is impossible to predict just how these spots will look next month, for sunspots are short-lived affairs, and change rapidly; but both groups are so large that it is probable that they will last through at least one more rotation of the sun.

The first group should cross the sun's central meridian about December 3, and the second on the 7th or 8th, so that both of them should be visible during the first ten days of the month. If they are anything like as conspicuous as they are now, they will be easily visible with a field-glass, and perhaps even with the naked eye.

As is often the case with great sunspots, the appearance of these groups has been accompanied by great magnetic and electrical disturbances on the earth, culminating in a "magnetic storm" of unusual violence, sufficient to disturb telegraph lines all over the world, and accompanied by a brilliant auroral display.

It is now pretty well established that the aurora is due to electrical action—probably electric currents—in the extemely rarefied outer layers of our atmosphere, perhaps 100 miles high. So this, together with the deflections of the magnetic needle and the "earth currents," which affected the telegraph lines, may be regarded as parts of one great disturbance of the earth's electrical and magnetic condition. If the coincidence of such a disturbance with the appearance of a large sunspot stood alone, it would mean nothing; but dozens of such instances are known, and, what is more, the number of magnetic storms rises and falls from year to year in exactly the same fashion as the number of sunspots. The correspondence of the curves representing the two is very striking, and extends even to minor details.

It follows that the sunspots and magnetic storms must be connected in some way or other. But we do not yet know what this connection is, or how it works. It would be unsafe to assume that the visible sunspots are the cause of the magnetic storms. Both may be due to some common cause, perhaps something acting deep down inside the sun. Whatever it is that happens, it must be on an enomorus scale. The recent magnetic storm supplied energy enough to run telegraph lines several hundred miles long without batteries; and it is obvious that such lines must have taken up only an infinitesimally small fraction of the energy of the earth currents. The total expenditure of energy must have been enormous. But where this energy comes from, and how it reaches us, we do not know.

It is improbable that the observed electro-magnetic disturbances are simply inductive effects from much greater ones on the sun. Lord Kelvin has calculated the amount of energy that would have to be spent in the sun to create a typical magnetic storm on the earth in this way, and it comes out so excessively great—greater in a few hours than all the energy which the sun radiates in the ordinary way in years—that the hypothesis seems very unlikely.

It is possible that a clew to the problem may be given by the recent discoveries in electrical science, especially those which have introduced to us the new ideas of electrons and of radio-activity. But, considering the present rapid growth of the department of physics, it seems to be as likely that the explanation, if we get it, will depend upon some yet undiscovered fact, as upon those that have become known in the last few years. For the present we must simply admit that, though the connection between sunspots and magnetic storms is unquestionably real, its nature is unknown.

As for any relation between the sunspot period and other terrestrial phenomena, such as the weather, all that can be said now is that the effect, if present at all, is small, and is so much covered up by much larger variations due to other causes, that there is still much discussion among scientific men concerning its reality.

THE HEAVENS.

The most brilliant region in the starry heavens is that which now occupies the eastern and southeastern sky. At 9 P. M. on the 15th Orion is well up in the southeast. The line of his belt points upward toward Aldebaran and the Pleiades, and downward to Sirius, which, though still low, already vindicates its claim to be the brightest of the fixed stars.

To the left of these constellations lie other hardly less conspicuous groups. Procyon, a little higher up than Sirius and considerably farther north, marks the constellation Canis Minor. Gemini lies above and Auriga still higher, near the zenith. Following the Milky Way westward, we first reach Perseus and then Cassiopeia. Farther south is Andromeda, below which in the west lies Pegasus.

Aries lies on the meridian below Perseus, marked by a triangle of unequal stars. Eridanus and Cetus occupy a large area in the south without affording any conspicuous objects. The southwestern sky is equally dull except for the presence of Jupiter.

Cygnus is low in the northwest, and Lyra still lower. Cepheus is sinking on the left of the pole, Draco and Ursa Minor are below, and Ursa Major beginning to come up again on the right.

THE PLANETS.

Mercury is evening star throughout December, but is at first too near the sun to be seen. During the last part of the month he is visible low in the southwest just after dark. On the 31st he sets an hour and a half later than the sun, but he is too far south to be conspicuous.

Venus is morning star, and is very brilliant all through the month. She is in Virgo, about 4 deg. north of Spica, on the 1st, and moves eastward into Libra during the month. On the 1st she rises at about 3 A. M., but as she is moving southward, she rises later every night, and on the 31st does not appear until nearly 4 o'clock.

Mars is evening star in Sagittarius and Capricornus, and sets about three hours after the sun. On the 20th he is in conjunction with Saturn, being a little more than half a degree south of him. As the two planets do not set till 7:30 P. M., they should be easily seen.

Jupiter is evening star in Aquarius, and is the most conspicuous feature of the evening skies. On the 7th he is in quadrature with the sun, and is due south at 6 P. M.

Saturn is evening star in Capricornus, and sets about 7:30 P. M. in the middle of the month.

Uranus is in conjunction with the sun on the 18th, and is invisible.

Neptune is in opposition on the 27th. He is in the western part of Gemini, his position on the 1st being R. A. 6h. 22m. 41s., dec. 22 deg. 15 min. 33 sec. north, and on the 31st 6h. 19m. 10s., dec. 22 deg. 17 min. 22 sec. He appears in small telescopes as a greenish star of the eighth or ninth magnitude, and, in the absence of a good star-chart, can only be surely identified by his motion. It requires a large telescope to show his disk, which is only 2½ seconds of arc in apparent diameter (about 1-20 of that of Jupiter).

THE MOON.

Full moon occurs at 1 P. M. on the 4th, last quarter at 6 A. M. on the 11th, new moon at 4 P. M. on the 18th, and first quarter at 9 P. M. on the 26th. The moon is nearest us on the 7th, and most remote on the 23d. She is in conjunction with Neptune on the 6th, Venus on the 14th, Uranus on the 18th, Mercury on the 20th, Saturn and Mars on the 22d, and Jupiter on the 25th.

At 7 P. M. on the 22d the sun reaches his greatest southern declination, enters the sign of Capricorn, and, in almanac parlance, "winter commences."

Cambridge Observatory, November 6, 1903.

REPORTING BY ELECTROPHONE.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

On the occasion of the recent speech at Birmingham of the Right Hon. Joseph Chamberlain, a remarkable journalistic development was accomplished by the London Evening News, which reported the speech in London and published it complete within twelve minutes of the speaker's resuming his seat. The feat was achieved by means of the electrophone.

Birmingham is 113 miles distant from the English metropolis. In the London editorial office of the Evening News an electrophone receiving station was established, comprising twelve receivers. At the hall where the speech was delivered, just in front of the speaker, were arranged on all sides electrophone transmitters in small boxes. The wires connected thereto were switched onto the wires of the national telephone system, which were carried into the hall for this purpose. These wires led to the Birmingham post office, where they were switched through onto the trunk cable to London. At the metropolitan post office they extended to the National Telephone Company's exchange, and thence to the newspaper office.

The task of reporting the speech was carried out by ten reporters, and their work was divided into two-minute spells of reporting, subsequently reduced to one-minute intervals as the speech neared completion. That is to say, the first shorthand reporter was connected to the wires for two minutes, then gave way to the second reporter, who also had a two-minute interval, and so on with the whole of the ten men in rotation. Then while No. 2 was reporting, the first shorthand writer who had been relieved transcribed his notes and was ready for another spell of reporting after the tenth man had completed his two minutes. In this manner the whole speech was reported *verbatim et literatim*. Then as fast as the shorthand notes were transcribed they were handed to the linotype operator, and the speech was composed and made ready for printing.

To guard against risk of breakdown of the cable, two other trunk cables were held in reserve, but the first cable proved sufficiently reliable for the work.

By this enterprising development the newspaper was enabled to obtain its report and publish the newspaper more than an hour before the first complete telegraphic report was received.

Mr. Chamberlain commenced his speech at 8:10 in the evening. The first batch of copy was sent to the composing room and set at 8:22. Mr. Chamberlain sat down at 10:05; the last batch of copy was sent to the linotype operator and set at 10:20. The type was cast, printed, and on sale in the street at 10:32, and the last batch of the telegraphic report was not received until 11:37, so that the electrophone beat the telegraph by 1 hour and 5 minutes.

The speech was set up and made up into columns from end to end, even including the last passages, which were not issued in the stop-press news space. Had the stop-press column been utilized for the last passages of the speech, the paper might have been published earlier.

The enterprise was purely an experiment, but was so successful that in future the electrophone will play an important part in the report of a great speech, since it is now realized that distance does not militate against the successful operation of the instrument. The words were heard with perfect distinctness, as if the reporters were in the room in which the speech was delivered. At times, it is true, the words of the speaker were drowned in the applause of the audience, and thus escaped the reporters, but that was a contingency against which they would have had to contend had they been present in the room, unless they had been exceptionally close to the speaker. Every sound in the hall was heard with extraordinary clearness.

SCIENCE NOTES.

To detect the presence of dissolved oxygen in water, A. Kaiser makes use of a solution of ferrous sulphate in boiled water acidulated with sulphuric acid. This solution is introduced by means of a pipette into a flask filled with the water to be examined; an excess of caustic potash solution is then added, the flask stoppered and shaken. If the water be rich in oxygen, the precipitate remaining in suspension immediately becomes of a yellow color, ferric hydroxide being formed. If little oxygen be present, only a greenish precipitate of ferrous hydroxide is formed, and with water free from oxygen, the precipitate remains of a greenish-white color. Small quantities of nitrates or nitrites present do not interfere with the reaction.—Journ. Soc. Chem. Ind., after Chem. Zeit.

The hypothesis that the energy lost by radio-active bodies should be recovered in the form of gravitation energy has frequently been made, and in a recent paper Herr Seigel tries to confirm this theory by exposing a small lead sphere to Becquerel rays, when a loss in weight would be noted. As, however, these losses seem to remain within the limits of possible experimental errors, T. Forch, in a note published in the Physikalische Zeitschrift, No. 11, proceeds to test his conclusions by repeating his experiments in a somewhat modified form. It results from the author's experiments that, with the radio-active substance used, no absorption of gravitation energy exceeding 1-25,000,000 of the mass of the lead will take place. A theoretical research by G. Kucera relative to the same subject is published in the same issue of the above periodical. The theoretical considerations Seigel bases himself on are tested and his assertion criticised, that the masses acting on the lead sphere should be taken as being condensed in the centers of gravity of the chords cut out by the surface of the earth and as being proportional to their length. In order to carry out an integration on a tri-dimensional figure, tri-dimensional elements should be chosen as elements of integration. Correcting in this way Seigel's calculations will modify them considerably.—A. G.

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A MOTOR "PULLMAN"—LORD ANGLESEY'S NEW MORS.

A singularly imposing car has been seen in London lately, under the pilotage of Mr. Montague Grahame-White, and excellent ideas of its exterior and interior alike are afforded by the accompanying illustrations. The Mors in question has just been sold to the Marquess of Anglesey. It is the only one of its type ever built, and has created quite a sensation wherever it has gone. The interior was completed from designs by Mr. Grahame-White, excellently carried out by Lamplugh et Cie, of Paris. A car of similar design is now being built for the Countess de Carrié, and will be shown at the Paris Salon in December.

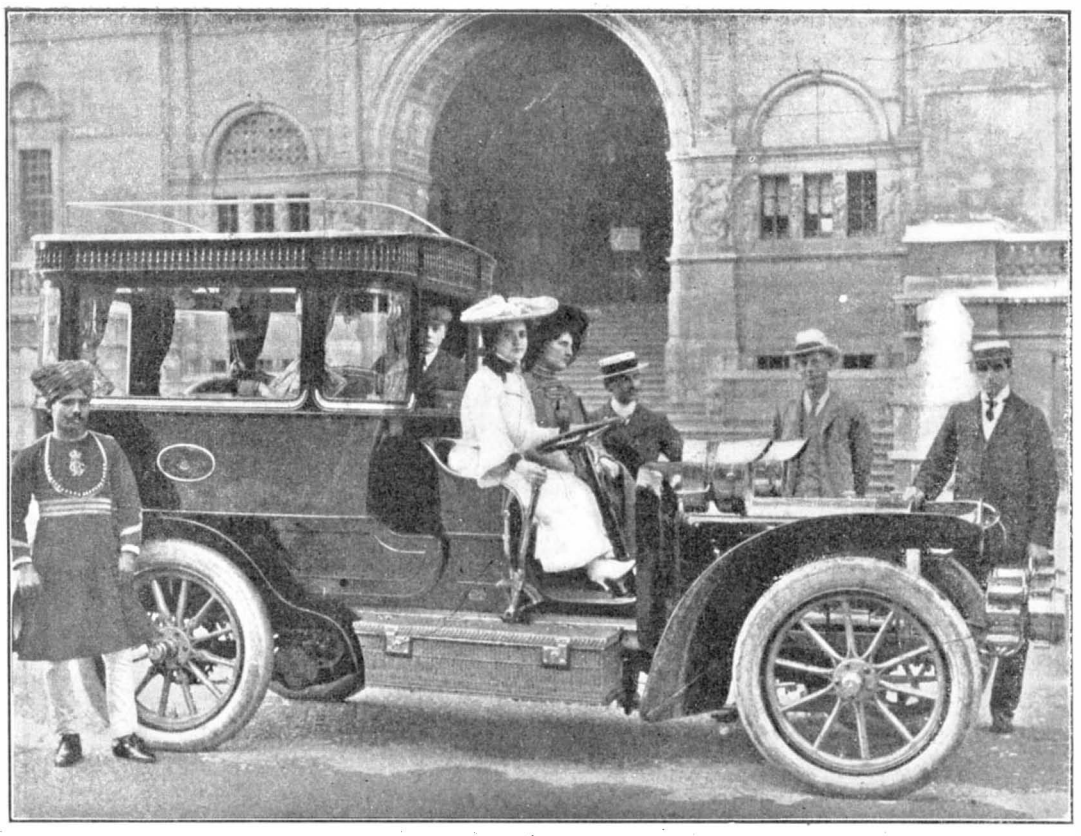
Mr. Grahame-White has supplied us with the following details of the Marquess of Anglesey's new acquisition:

This car was specially designed and built to represent the finest work it is possible to embody in the production of the latest automobile carriage. The cost was not taken into consideration at all, but the chassis and carriage work were the outcome of many months' thought and consideration. The idea was to produce a car with all the comforts of a Pullman carriage, now well known on the leading railway systems in England.

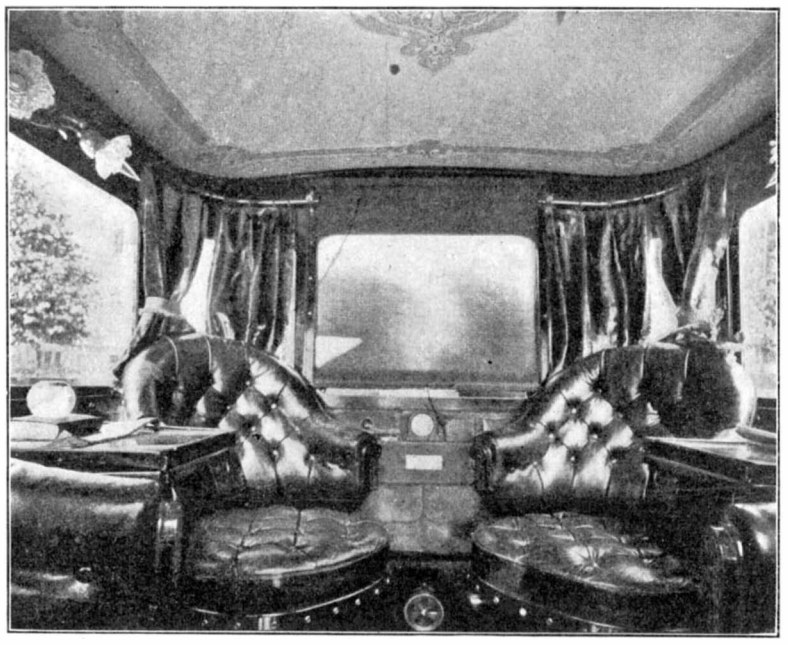
The frame is specially constructed with a wheel base of 10 feet 6 inches and suspended on extra long springs, with equal size wheels, all of which are fitted with 120 mm. Continental tires giving a smoothness of running hitherto unknown. The engine is of the new Mors type with four cylinders, giving between 35 and 40 horse power on the brake, having a four-throw crank and double cam shafts, mechanically operating both induction and exhaust valves.

Magneto ignition is fitted with the usual "make and break" firing. The motor is extremely silent when throttled, and an extra lever is fitted to the top of the steering wheel which regulates the time of firing by altering the position of the cam shaft actuating the tappet rods. The radiator is of the well-known Mercédès type and fan cooled. The firing of each cylinder can be tested independently by releasing the spring contact rods forming the circuit to the sparking plugs, each cylinder being hinged to a rod forming positive conduct from the magneto.

The pump, cam shaft, and magneto gear wheels are made of 1¼ inch fiber with a center strip of brass, which give very silent running. The fan is driven from the magneto shaft by a belt. The main crank shaft bearings are lubricated by a geared lubricator, while the cylinders themselves are splash lubricated by the dip of the connecting rods in the base chamber.



THE 35 H. P. "PULLMAN" MORS JUST ACQUIRED BY THE MARQUESS OF ANGLESEY.



PART OF THE INTERIOR OF THE "PULLMAN" MORS.

The exhaust box is arranged with an additional fitting by which the engine can be still more muffled in traffic and allowed to exhaust comparatively free when in the open country or ascending steep hills.

The body is, as already stated, fitted as a Pullman car, as will be seen by the accompanying photograph; it has large windows at the sides and ends, and at each corner curved panes, all of beveled plate glass. Sliding ventilators are fitted above these, and the front glass is made to drop inside the frame of the body. All the windows are fitted with spring sun blinds. The inside is fitted with four revolving armchairs, one at each corner, luxuriously upholstered in dark red morocco leather. The whole of the inside woodwork is of polished mahogany. In between these are two side tables forming small cupboards and drawers. The tops of these are polished, while they can be opened up to form one large table covered on the face with green baize.

The front of the car inside (behind the driver's seat) is fitted with a morocco leather holdall, comprising clock, barometer, thermometer, manicure set, note books, looking glass, and an electric telephone to the driver with an indicator marked *right*, *left*, *turn*, *steady*, *home*, *quicker*, *etc.*

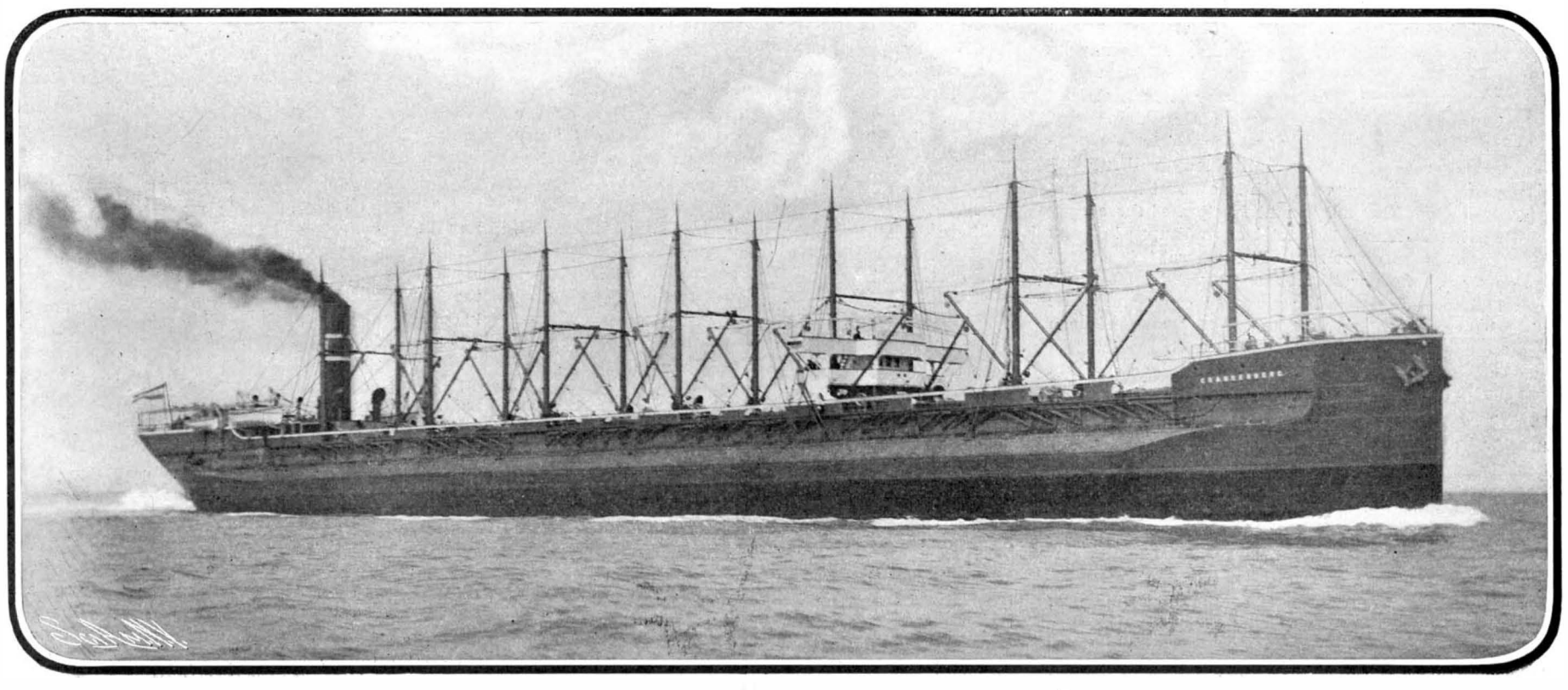
There are two electric light sprays, each having two 8 candlepower lights with glass shades, which derive their power from two sets of accumulators giving 16 volts each. These are placed in the well of the car between the driver's seat and the main body. A heating apparatus for the winter (which can be connected to the exhaust at will) is also provided.

The ceiling is decorated in the Louis XV. style, while the car is furnished with royal blue plush curtains. The dashboard is of the hooded Daimler pattern, and is fitted with main sight lubricator, clock, gradometer, voltmeter, and the direction indicator connecting with the inside of the car. On the roof provision is made for carrying a good supply of luggage. The whole of these are lit electrically at night. The car is also fitted with four large size brass Blériot acetylene lamps, one pair giving light laterally, and the other showing direct on to the road. The two top doors of the bonnet are covered with copper sheeting, the fittings throughout are all brass plated; frame and wheels are painted in pale yellow and lined black; the body is dark blue with fine red lines; two side baskets are fitted between the steps and rear mudguards, capable of carrying a large supply of tools.

The car is geared to travel at an average speed of twenty-five miles an hour with a full load. These particulars as well as the illustrations are taken from The Car.

THE "GRANGESBERG"—A GIANT ORE-CARRYING STEAMER.

The "Grangesberg" is a recently constructed steamer intended to carry iron ore from the Baltic to Rotterdam, and was built to the order of Messrs. W. H. Muller & Co., of Rotterdam. To unload her in the ordinary way would take a fortnight. With her ingenious equipment of derricks she will be able to unload in 30 hours.



THE NEW ORE-CARRYING STEAMER "GRANGESBERG."

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She has 14 masts ranged in two lines on each side of the hatchways. To each of the masts, except the pairs at both ends, are fixed two derricks, and to each mast of the end pair is fixed one derrick. She has thus 24 derricks, and they are so arranged that they can all be worked together. The ship has no 'tween-decks. Instead, she has 12 holds, each hold being divided lengthwise into two compartments.

There are thus 24 compartments, and each derrick has one twenty-fourth of the ship to unload. Obviously this is a vastly quicker method than the present slow practice, whereby often only a couple of derricks are able to work on a whole cargo—one at the forward hatchway, and one at the aft.

The masts can, if necessary, be used for sails, but the spread of canvas will be very small. She will rely on her engines, which are of 2,200 horse power. Her contract speed is 10 knots an hour, but on being tested over the measured mile she is stated to have traveled at the rate of 10½ knots.

Her dimensions are: Length, 440 feet; beam, 62 feet; depth, 29 feet. When loaded with her cargo of 10,300 tons she draws 22 feet 8 inches.

PHOTOGRAPHY BY ELECTRIC DISCHARGES.

M. Stephan Leduc, professor of biological physics at the Ecole de Médicine of Nantes, presented at a late exposition of the Société Française de Physique several remarkable photographs produced by electric discharges. The following interesting facts have been procured from Prof. Leduc:

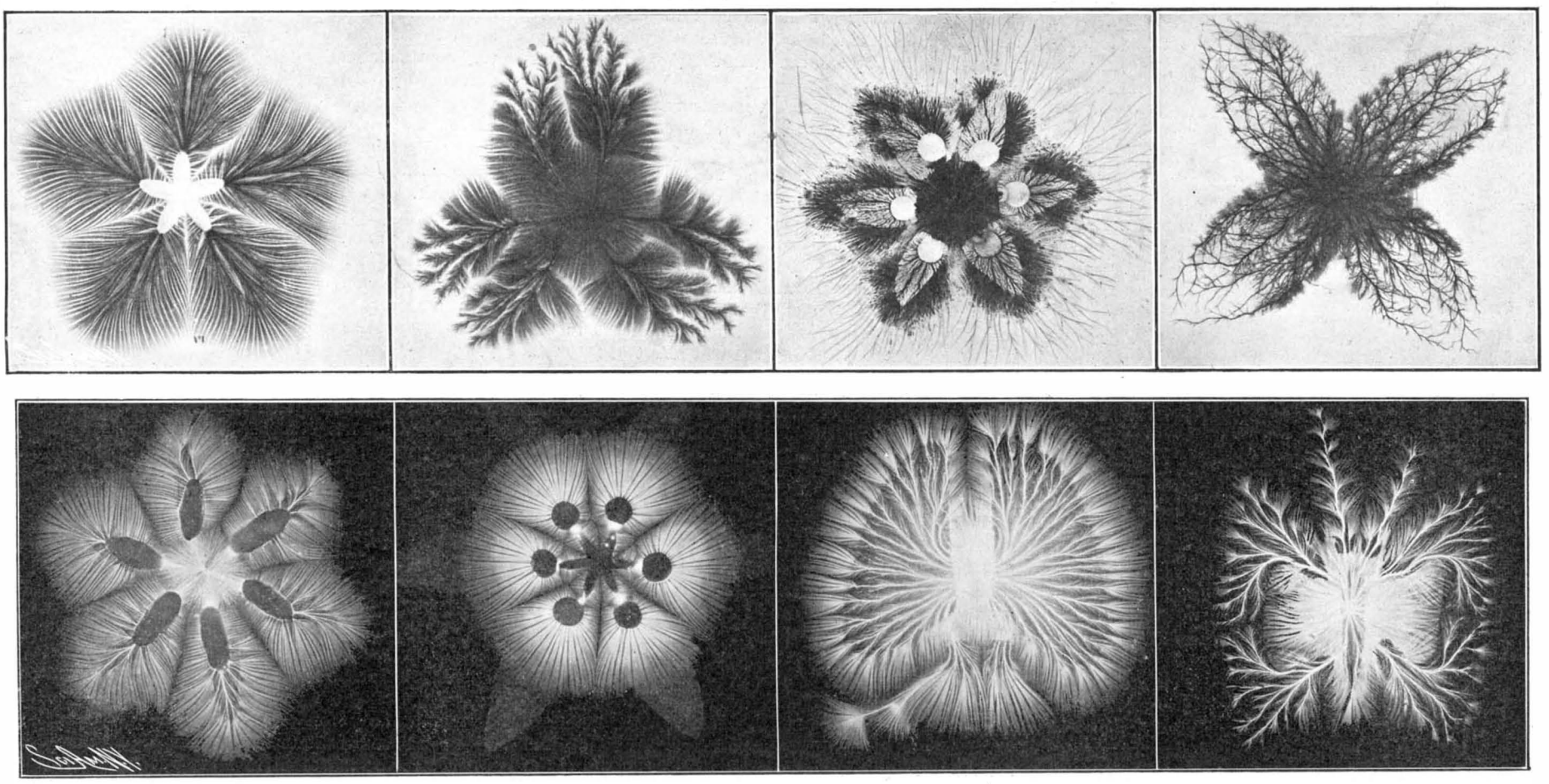
The object is to direct the electric discharge on the sensitive plate, so as to render it regular and symmetrical, while producing designs capable of furnishing *motifs* for ornamentation which may be indefinitely varied. In order to do this, the sensitive plate must be thus prepared: In the dark room lighted with red light, a dry plate coated with gelatino-bromide of silver is covered with pasteboard, from which previously the symmetrical design desired to be produced by the electric discharge has been cut out; the plate is sprinkled by means of a sieve with an insulating powder, such as fecula, starch, sulphur, or a powdered oxide or metallic salt. Then the pasteboard is taken off; the cut-out design is reproduced on the sensitive surface by the powder, the remainder of this surface remaining clean and smooth.

The result may be varied not only by employing different designs, but by distributing over the sensitive surface pieces of tin, lead, copper, etc., cut variously. The powders give to the lines more or less firmness, according to their fineness and density; the most compact powders give the finest lines, and a great diversity in appearance may be obtained by employing different powders variously distributed by means of several pasteboard covers.

The plate coated with gelatino-bromide of silver thus prepared is placed with its non-sensitive side on a metallic leaf, put in communication with one of the poles of the generator of electricity.

On the sensitive surface, in the center of the symmetrical design formed by the powder, a metallic point is placed, which communicates with the other pole of the generator. The differences of the poles likewise contribute in varying the results.

In the operation thus conducted the plate coated with gelatino-bromide of silver represents the dielectric of a condenser, of which the leaf and the metallic point form the armatures. Only one discharge is produced; the plate is carefully dried with a dry cloth, so that no powder may be left, and is then developed in the usual way. That the result is always unforeseen, makes these experiments quite fascinating. As a generator of electricity, either an induction coil (Ruhmkorff coil) or a static machine may be utilized, and the smallest generators are sufficient.



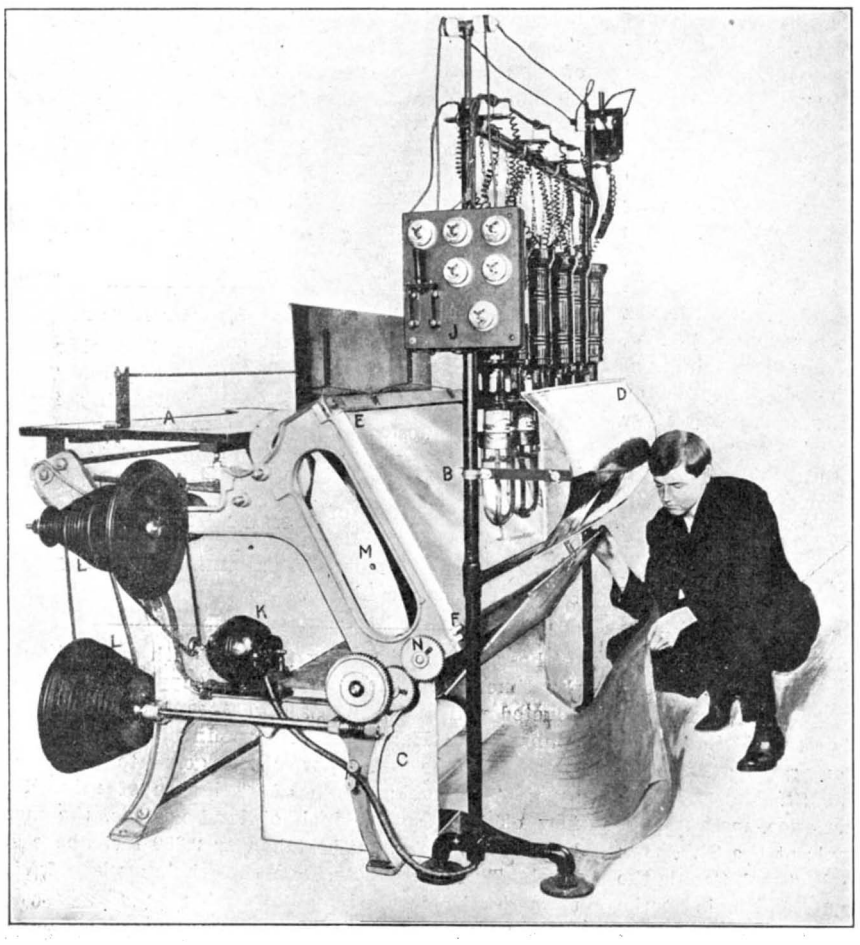
ORNAMENTAL PATTERNS PRODUCED UPON SPECIALLY-TREATED PLATES BY ELECTRICAL DISCHARGES.

ELECTRIC BLUE-PRINT MACHINERY.

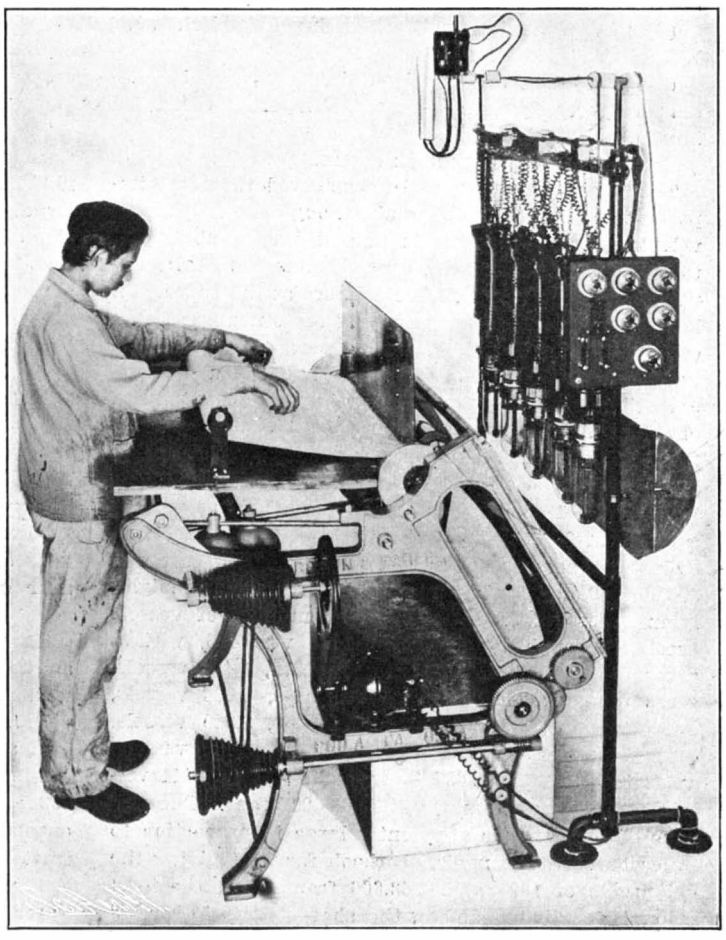
The great value of electricity for blue printing has long been recognized, permitting as it does the production of prints immediately upon completion of the tracings without the inconvenience and delay caused by cloudy or rainy weather.

Manufacturers, architects, and engineers have long appreciated the fact that a good machine for this purpose would be invaluable, because it would enable them to obtain blue prints at any hour of the day or night without loss of time from atmospheric conditions, and without obliging the operator to remain idle during rainy weather.

The Franklin electric blue-print machine, manufactured by Williams, Brown & Earle, of Philadelphia, represents the latest and best type of its kind and



Examining the Finished Print.



Guiding the Paper.

THE FRANKLIN BLUE-PRINTING MACHINE.

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overcomes entirely the many objections to the machines now in use for this purpose.

The portion of the machine by which the printing is accomplished consists of two continuous bands of transparent celluloid. Each of these bands is held firmly in position by two rollers, of which one is an idler and the other a driving roller which actuates the band. The driving rollers are geared together and revolve at exactly the same rate of speed, causing the bands to move synchronously. The transparent celluloid bands, as they travel from one roller to the other, pass over a convex surface or "hump," shaped in the section of a cylinder, and are held in absolute contact with this surface and with one another by an automatic adjustable tension device. In order to make a print, the tracing and sensitized paper are introduced between the transparent bands, by means of which they are held in absolute contact with one another, and in this position pass in front of the electric lamps. The printing is thus accomplished automatically; and the action of the machine being continuous, prints of any length can be made, or one separate print after another may be obtained in rapid succession.

The lamps and motor are furnished for the direct or alternating currents of 104, 110, or 220 volts. Either four or five inclosed arc electric lamps are used. These lamps are each arranged to pass from 2¾ amperes on the 220-volt current to 5 amperes on the 104 and 110 volt currents, making a very low cost of operation.

The motor is of 1-10 horse power and can be furnished for any current or voltage. By an ingenious cone device the speed of the bands may be altered so that the tracings and sensitized paper pass at a rapid or slow speed across the convex surface, thus making either a long or short exposure.

Prints can be made at a maximum speed of one minute exposure, or a minimum speed of 10 minutes. This great range permits all kinds of sensitized paper to be used. Tracings of any density, including paper negatives, drawings on bond paper or crumbled tracings, are all printed with ease by any intelligent boy. Thus is it possible to make prints by electric light, rapidly, at a low cost, of any size and continuously, without stopping or readjusting the machine.

Other Ship Canals Than Panama.

The renewed attention being given to the proposed isthmian canal at this time lends especial interest to a discussion of the great canals of the world, presented by the Department of Commerce and Labor through its Bureau of Statistics. The ship canals of the world, it says, are nine in number, as follows:

(1) The Suez Canal, begun in 1859 and completed in 1869.

(2) The Cronstadt and St. Petersburg Canal, begun in 1877 and completed in 1890.

(3) The Corinth Canal, begun in 1884 and completed in 1893.

(4) The Manchester Ship Canal, completed in 1894.

(5) The Kaiser Wilhelm Canal, connecting the Baltic and North seas, completed in 1895.

(6) The Elbe and Trave Canal, connecting the North Sea and Baltic, opened in 1900.

(7) The Welland Canal, connecting Lake Erie with Lake Ontario.

(8 and 9) The two canals, United States and Canadian, respectively, connecting Lake Superior with Lake Huron.

THE SUEZ CANAL.

The Suez Canal is usually considered the most important example of ship canals, though the number of vessels passing through it annually does not equal that passing through the canals connecting Lake Superior with the chain of Great Lakes at the south. In length, however, it exceeds any of the other great ship canals, its total length being 90 miles, of which about two-thirds is through shallow lakes. The material excavated was usually sand, though in some cases strata of solid rock from 2 to 3 feet in thickness were encountered. The total excavation was about 80,000,000 cubic yards under the original plan, which gave a depth of 25 feet. In 1895 the canal was so enlarged as to give a depth of 31 feet, a width at the bottom of 108 feet and at the surface of 420 feet. The original cost was $95,000,000, and for the canal in its present form slightly in excess of $100,000,000. The number of vessels passing through the canal in 1870 was 486, with a gross tonnage of 654,915 tons; in 1875, 1,494 vessels, gross tonnage, 2,940,708 tons; in 1880, 2,026 vessels, gross tonnage, 4,344,519 tons; in 1890, 3,389 vessels, gross tonnage 9,749,129 tons; in 1895, 3,434 vessels, gross tonnage, 11,833,637 tons; and in 1900, 3,441 vessels, with a gross tonnage of 13,699,237 tons. The revenue of the canal is apparently large in proportion to its cost, the Statesman's Yearbook for 1901 giving the net profits of 1899 at 54,153,660 francs, and the total amount distributed among the shareholders 51,538,028 francs or about 10 per cent of the estimated cost of $100,000,000.

The canal is without locks, being at the sea level the entire distance. The length of time occupied in passing through the canal averages about eighteen hours. By the use of electric lights throughout the entire length of the canal passages are made at night with nearly equal facility to that of the day. The tolls charged are 9 francs per ton net register, "Danube measurement," which amounts to slightly more than $2 per ton United States net measurement. Steam vessels passing through the canal are propelled by their own power.

THE CRONSTADT AND ST. PETERSBURG CANAL.

The canal connecting the Bay of Cronstadt with St. Petersburg is described as a work of great strategic and commercial importance to Russia. The canal and sailing course in the Bay of Cronstadt are about 16 miles long, the canal proper being about 6 miles and the bay channel about 10 miles, and they together extend from Cronstadt, on the Gulf of Finland, to St. Petersburg. The canal was opened in 1890 with a navigable depth of 20½ feet, the original depth having been about 9 feet; the width ranges from 220 to 350 feet. The total cost is estimated at about $10,000,000.

THE CORINTH CANAL.

The next of the great ship canals connecting bodies of salt water in the order of date of construction is the Corinth Canal, which connects the Gulf of Corinth with the Gulf of Ægina. The canal reduces the distance from Adriatic ports about 175 miles and from Mediterranean ports about 100 miles. Its length is about 4 miles, a part of which was cut through granite soft rock and the remainder through soil. There are no locks, as is also the case in both the Suez and Cronstadt canals, already described. The width of the canal is 72 feet at bottom and the depth 26¼ feet. The work was begun in 1884 and completed in 1893 at a cost of about $5,000,000. The average tolls are 18 cents per ton and 20 cents per passenger.

THE MANCHESTER SHIP CANAL.

The Manchester Ship Canal, which connects Manchester, England, with the Mersey River, Liverpool, and the Atlantic Ocean, was opened for traffic January 1, 1894. The length of the canal is 35½ miles, the total rise from the water level to Manchester being 60 feet, which is divided between four sets of locks, giving an average to each of 15 feet. The minimum width is 120 feet at the bottom and averages 175 feet at the water level, though in places the width is extended to 230 feet. The minimum depth is 26 feet, and the time required for navigating the canal from five to eight hours. The total amount of excavation in the canal and docks was about 45,000,000 cubic yards, of which about one-fourth was sandstone rock. The lock gates are operated by hydraulic power; railways and bridges crossing the route of the canal have been raised to give a height of 75 feet to vessels traversing the canal, and an ordinary canal whose route it crosses is carried across by a springing aqueduct composed of an iron caisson resting upon a pivot pier. The total cost of the canal is given at $75,000,000. The revenue in 1901, according to the Statesman's Yearbook, was £621,128, and the working expenses, £483,267. For the half year ending June 30, 1900, the canal yielded £16,488 toward paying the £112,500 of interest which the city of Manchester has to pay on the capital invested in the enterprise. The freight-paying tolls on the canal amounted to 1,487,841 tons in the half year, an increase of 12 per cent over that of the corresponding period of the preceding year.

THE KAISER WILHELM CANAL.

Two canals connect the Baltic and North seas through Germany, the first, known as the Kaiser Wilhelm Canal, having been completed in 1895 and constructed largely for military and naval purposes, but proving also of great value to general mercantile traffic. Work upon the Kaiser Wilhelm Canal was begun in 1887, and completed, as above indicated, in 1895. The length of the canal is 61 miles, the terminus in the Baltic Sea being at the harbor of Kiel. The depth is 29½ feet, the width at the bottom 72 feet, and the minimum width at the surface 190 feet. The route lies chiefly through marshes and shallow lakes and along river valleys. The total excavation amounted to about 100,000,000 cubic yards, and the cost to about $40,000,000. The number of vessels passing through the canal in 1900 was 21,571, with a tonnage of 4,282,258, and the dues collected amounted to 2,133,155 marks.

SHIP CANALS CONNECTING THE GREAT LAKES OF NORTH AMERICA.

Three ship canals intended to give continuous passage to vessels from the head of Lake Superior to Lake Ontario and the St. Lawrence River are the Welland Canal, originally constructed in 1833 and enlarged in 1871 and 1900; the St. Marys Falls Canal at Sault Ste. Marie, Mich., opened in 1855 and enlarged in 1881 and 1896; and the Canadian canal at St. Marys River, opened in 1895. In point of importance, measured at least by their present use, the canals at the St. Marys River by far surpass that of the Welland Canal, the number of vessels passing through the canals at the St. Marys River being eight times as great as the number passing through the Welland, and the tonnage of the former nearly forty times as great as that of the latter. One of the important products of the Lake Superior region, iron ore, is chiefly used in the section contiguous to Lake Erie, and a large proportion of the grain coming from Lake Superior passes from Buffalo to the Atlantic coast by way of the Erie Canal and railroads centering at Buffalo. The most important article in the westward shipments through the Sault Ste. Marie canals—coal—originates in the territory contiguous to Lake Erie. These conditions largely account for the fact that the number and tonnage of vessels passing the St. Marys River canals so greatly exceed those of the Welland Canal.

The Welland Canal.—The Welland Canal connects Lake Ontario and Lake Erie on the Canadian side of the river. It was constructed in 1833 and enlarged in 1871 and again in 1900. The length of the canal is 27 miles, the number of locks 25, the total rise of lockage 327 feet, and the total cost about $25,000,000. The annual collection of tolls on freight, passengers, and vessels averages about $225,000 and the canal is open on an average about two hundred and forty days in a year.

The Sault Ste. Marie Canals.—The canals of Sault Ste. Marie, Mich., and Ontario, are located adjacent to the falls of the St. Marys River, which connects Lake Superior with Lake Huron, and lower or raise vessels from one level to the other, a height of 17 to 20 feet. The canal belonging to the United States was begun in 1853 by the State of Michigan and opened in 1855, the length of the canal being 5,674 feet, and provided with two tandem locks, each being 350 feet in length and 70 feet wide, and allowing passage of vessels drawing 12 feet, the original cost being $1,000,000. The United States government, by consent of the State, began in 1870 to enlarge the canal, and by 1881 had increased its length to 1.6 miles, its width to an average of 160 feet, and its depth to 16 feet; also had built a single lock 515 feet long and 80 feet wide, with a depth of 17 feet on the sills, which was located 100 feet south of the State locks. The State relinquished all control of the canal in March, 1882. In 1887 the State locks were torn down and replaced by a single lock 800 feet long, 100 feet wide, and a depth of 22 feet of water on the sills. This lock was put in commission in 1896. The canal was also deepened to 25 feet. The Canadian canal, 1⅛ miles long, 150 feet wide, and 22 feet deep, with lock 900 feet long, 60 feet wide, with 22 feet on the miter sills, was built on the north side of the river during the years 1888 to 1895. The number of vessels passing through the United States canal in 1902 was 17,588, and through the Canadian canal 4,204. In 1900 the number of vessels passing through the United States canal was 16,144, and through the Canadian canal, 3,003, showing an increase of 1,200 in the number of vessels passing through the Canadian canal, and a slight decrease in the number through the United States canal, the increase in the number passing through the Canadian canal having been due to the development of the Michipocoten district. The tonnage passing through the United States canal in 1902 was: Registered tonnage, 27,408,021 tons; in 1901, 22,222,334 tons, against 20,136,782 in the year 1900; the freight tonnage in 1901 was 25,026,522 tons, against 23,251,539 tons in 1900. The Canadian canal shows: Registered tonnage in 1902, 4,547,561; in 1901, 2,404,642 tons, against 2,160,490 in 1900. A marked contrast between the business of the St. Marys Falls and Welland canals is found in a comparison of their figures for a term of years. The number of vessels passing through the Welland Canal in 1873 was 6,425, and in 1899, 2,202, a reduction of more than one-half in the number of vessels. The number of vessels passing through the St. Marys Falls Canal in 1873 was 2,517, and in 1902, through the American and Canadian canals, 22,659.

A Convention on Mosquito Exclusion.

A convention is called to be held on December 16 in New York, at the rooms of Board of Trade and Transportation, in the Mail and Express Building, in the interests of "Mosquito Extermination." It is expected much interesting data will be given; and in view of the well-known fact that certain species of mosquitoes promote the spread of malaria, the subject becomes one of special public interest, particularly as the proposed general mosquito extermination will greatly benefit the public health.

Those who are looking forward with trepidation to the time when the world's coal supply shall be exhausted will find solace in some rough calculations by John Clarke Hawkshaw, a prominent civil engineer, concerning the water power now going to waste. He says: "Assume a depth of 10 inches of rainfall to flow off each square inch of land surface, the mean height of which may be taken as 2,250 feet above sea level. Then the water from the whole surface falling through the mean height would give 10,340,000,000 horse power in perpetuity. Our present yearly output of 225,000,000 tons of coal would give that horse power for only a little over half a day."

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The Mexican Cotton-Boll Weevil and the Damage It Has Caused This Season.

The most serious menace that the cotton planters of the South have ever been compelled to face is the Mexican boll weevil, which is ravaging the cotton fields of Texas. The weevil has not been found outside that State except in the instance which occurred in August at the Louisiana Sugar Experiment Station at Audubon Park in the environs of New Orleans. In that case the circumstances have led the Louisiana authorities to the conviction that the pests were purposely placed in the cotton plots by some interested person. The station authorities promptly destroyed all the cotton of the experimental plots by picking the fallen fruit, uprooting and burning the plants, and subsequently plowed and flooded the land after it had been thoroughly sprayed with crude petroleum. As there are no cotton fields within 10 miles of Audubon Park, and several examinations by the station entomologist failed to reveal any weevils, it is very probable that the colony was completely exterminated.

The difficulties in the way of controlling the boll weevil lie as much in its habits and manner of work as in the peculiar industrial conditions involved in the production of the staple in the Southern States. The weevil lives in all stages, except the imago, within the fruit of the plant well protected from any poison that may be applied, and in that stage takes food only by inserting its beak within the substance of the plant. It is remarkably free from the attacks of parasites and diseases, occupies but fourteen days for development from egg to adult, and the progeny of a single pair in a season may reach 134,000,000 of individuals.

The weevil adapts itself to climatic conditions to the extent that the egg stage alone in November may occupy as much time as all the immature stages together in July or August. These factors combine to make it one of the most difficult insects to control.

The territory at present affected by the boll weevil is entirely in Texas. The nearest approach to the Louisiana line is in the immediate vicinity of Timpson, 25 miles away. The nearest approach to Shreveport is in Wood County, about 100 miles distant. On the north it has been found in the vicinity of Sherman just south of the Red River. In the region between the latitude of Greenville and the Red River the weevil is only scatteringly present and has caused no general damage. It will require nearly two years for it to reach such numbers as to materially reduce the normal production. Although many conditions make it very difficult to reduce to figures the damage caused by the weevil, calculations made in the Division of Entomology of the U. S. Department of Agriculture, based upon statements showing the production of cotton in ten leading counties in Texas when the boll weevil was absent and when it was present, and showing the increase in ten other counties when the weevil was absent at both similar periods, appear to justify the estimate that the total damage caused by the insect is about 50 per cent. Upon that basis the Texas planters have suffered a loss of $15,000,000 during the present season, and this estimate, it is stated, agrees with those of conservative cotton statisticians. As the normal cotton crop of the United States is estimated to represent a value of $500,000,000, the probable ultimate damage, when the pest has become spread over the entire cotton belt, provided nothing were done to check it, would be in the neighborhood of $250,000,000 annually.

Nevertheless there are conditions at work that seem to indicate that planters in weevil regions are gradually adopting changes in their system of producing the staple that have a tendency to avoid damage.

The work of the U. S. Department of Agriculture with the boll weevil consists of field experiments and laboratory investigations. Mr. W. D. Hunter, of the Division of Entomology, assisted by several entomologists, has charge of the investigations in Texas, and Mr. E. A. Schwarz of the Division has conducted studies in Cuba. The field work comprises tracts of cotton grown in such manner as to constitute demonstrations of the means necessary in order that the staple may be produced profitably in spite of the weevil. These fields are located in six different points representing the five regions in Texas, which, by reason of variation in climate and soil, constitute as many distinct cotton districts. In these fields every expedient that has been found to be useful in avoiding damage by the weevil is being tried. The work of the Division of Entomology during the season of 1902 demonstrated that it is possible to produce cotton profitably in spite of the weevil; the work of the present season shows this again under different conditions of climate and soil, and in addition furnishes practical demonstrations of the value of the recommendations of the Division to planters at six different points in the State. In the laboratory the life history of the pest is being carefully investigated. In addition, Mr. Schwarz has spent several months of the present year in Cuba, studying the manner in which natural conditions, whether of parasites, diseases, climatic conditions, or of bringing about a degree of resistance on the part of the plant, control the insect where it has existed as an enemy of the cotton plant for a much longer period than in the United States. He found what he supposes to be the original food plant of the insect in the "algodon de riñon" or kidney cotton of that island. He failed to discover any parasites at all and did not succeed in finding any important tendency toward immunity on the part of the five distinct varieties studied.

The steady extension of the territory affected by the weevil year by year until the northern boundary is far north of the center of cotton production in the United States has convinced all observers that it will eventually be distributed all over the cotton belt. Although its progress has been comparatively slow during the time it has been in Texas, it has displayed no tendency toward dying out.

The fact that several European governments are sending agents to this country to procure seed to be used in experiments in producing the fiber in their colonies calls attention to the probability that the weevil may be carried to remote portions of the globe. Although the insect does not, except accidentally, hibernate within the hull of the seed, every seed house attached to a gin in the infested territory harbors any that are brought in from the fields in seed cotton. They crawl into the seed bins as they would crawl anywhere for protection. All danger could easily be avoided by fumigation of the seed or by leaving it sacked in storage rooms isolated from new cotton for a year previous to shipment.

The work of the Division of Entomology has demonstrated that no direct or specific means, such as poisons, will ever be of much avail in fighting the weevil and that there is little hope for the artificial propagation of diseases or in obtaining a variety that is in any sense resistant. Experiments, however, with cultural methods have been highly successful and have obviated the necessity of looking to direct ones.

The cultural methods consist of reducing the number of the pests in the fall by early destruction of the plants and in hastening the maturity of the crop the following spring by every means available. Fall destruction consists of plowing up and burning the plants as soon as the pests have multiplied to such an extent as to render the picking of any more cotton doubtful. Under normal conditions this should occur some time in October. The benefits resulting from this process are threefold. Many weevils are actually killed, the development of several of the so-called broods is prevented, thus further reducing the number which go into hibernation, and, moreover, the hibernating season, during which many causes bring about a considerable mortality, is lengthened.

While this apparently causes a loss of the top crop, it is not a loss when the other recommendations of the Division of Entomology are followed. A crop can be obtained which will mature before the weevils have an opportunity to do considerable damage, and this is brought about by the use of a rapid-growing variety accomplished by the planting of northern seed. This must be planted early when the season permits; the rows must be planted at a somewhat wider distance than has been the practice, and a thorough cultivation of the crop must follow. In this way it has been shown the past season that from a half bale to a bale per acre can be cropped in territory where under the old system one-tenth of a bale more or less is secured with difficulty.

By these methods it is possible to produce the staple at a margin of profit that will compare favorably with that realized in the production of most of the staple crops of the United States, even though the large yields of cotton occasionally gained in earlier years seem no longer possible in the districts affected by the weevil.

Slight Display of Leonids, A.M. November 16, 1903.

BY PROF. EDGAR L. LARKIN.

A watch was maintained for Leonid meteors at this observatory, from 0h. 40m. to 2h. 5m. A. M. on Monday, November 16, 1903. The display was feeble indeed when compared with the magnificent shower observed here on November 15, 1901, when 661 were recorded. Twelve Leonids were seen this year; the first being at 0h. 44m. and the last at 2h. 5m. A. M. Pacific time. They were all from within the sickle of Leo; two from the radiant point, that is, almost exactly "head on." The first from radiant was at 1h. 4m., and the other at 1h. 22m., and were equal in brilliancy to Gamma Leonis. The brightest meteor was equal to Arcturus, the others small. At 2h. 5m. a mountain fog condensed, ending the watch. No observations were made on the morning of the 15th, owing to fog. At 6h. 10m. and at 6h. 23m. P. M. on November 14, two meteors were seen in the south, in thin fog; and from the illumination of the vapor, it was thought that their brilliancy was as intense as that of Jupiter, which was shining through the same layer. At 5h. 30m. A. M. a bright light flashed in all the rooms of the observatory, which must have been from a large meteor, as quite a dense cloud inclosed the peaks and building at the time. This was on Sunday morning, November 15, 1903.

Lowe Observatory, November 16, 1903.

THE OBELISK OF MONT PELÉ.

Mont Pelé stands unique in the history of volcanoes in more than one particular. A little over a year ago, scientists who were studying this volcano discovered a peculiar tooth-like formation growing out of the old crater. Owing to the quantity of vapor and smoke which covered the mountain, this formation was not observed until it had grown to a height of 295 feet above the rim of the crater. The formation could not be mistaken for a cone, such as is commonly formed in craters by the heaping up of matter ejected from the volcano, since the sides were quite smooth, and approximately vertical, as shown in our front-page illustration. It had rather the appearance of a solid shaft of stone, and was hence called the "obelisk of Pelé." From the time it was first discovered it steadily increased in height, and when measured in the latter part of March, 1903, it was estimated to be 5,143 feet above the level of the sea, or 1,109 feet above Morne Lacroix, but this did not mark the maximum height, because a period of heavy volcanic explosions had reduced it somewhat and caused its form to undergo many changes. Thus, during the spring and last summer it constantly altered in height and general appearance, sometimes rising a number of yards, and then, following a period of explosions, being reduced again. From the time of its measurement in March, the losses exceeded the gains until it finally disappeared within the cone which had been formed about it. This cone seems to be made up of lava and ejecta which have been forced up from the vents, and of masses which have been shattered from the obelisk.

The peculiar phenomena of the obelisk have awakened great interest. How such a huge monument, taller than the Effel Tower, could be formed on the top of a violently active volcano is a problem that is not easy of solution. As far as we can ascertain, only one plausible theory has been advanced, and that does not seem very credible; namely, that the needle was formed of molten lava during some previous period of activity, that this lava solidified and formed a plug which closed one of the passages of the crater, and that now it has been worked loose and forced up by the recent renewed activity. The obelisk does have the appearance of having been forced up in a solid piece like a stopper in the bottle, and held by friction against the sides of the opening. The northeast side of the obelisk is very smooth, almost polished in appearance. Its true color, however, is a reddish brown partly covered with a whitish incrustation. On the southwest side fresh surfaces are constantly appearing, owing to the explosions, which cause portions to continually fall off. This side has a gray or reddish-gray appearance. It is impossible at the present time to state just exactly what the nature of the needle is, though in all probability it is largely pumiceous, which is judged from the fact that masses break off from it so easily, and also because of the abundance of pumice found in the vicinity of the Rivière Blanche.

These particulars have been abstracted from an elaborate discussion of the phenomena of Martinique by E. O. Hovey, published in full in the current SUPPLEMENT. Mr. Hovey was twice sent to the scene of the volcanic eruptions for purposes of study—once by the American Museum of Natural History, and once by the National Geographic Society. The photograph reproduced on the front page of this issue was taken by Mr. Hovey for the American Museum of Natural History.

The Current Supplement.

Emile Guarini concludes his account of the Viennese Metropolitan Railway in the current SUPPLEMENT No. 1457. Dr. O. Boudouard discusses at length the subject of "Alcohol as a Motive Power." A tandem compound express locomotive for the Russian imperial railways is described. "Some Engineering Features of Drainage" is a subject which C. G. Elliott, drainage expert of the Department of Agriculture, treats in a masterly way. Recent advances in Roentgen ray apparatus are outlined and illustrated. Dr. Salmon's paper on "Infectious and Contagious Diseases of Farm Animals and Their Effect on American Agriculture" is concluded. William Finn tells much that is interesting about the influence of sunspots upon electrical and magnetic forces of the earth. O. F. Cook's article on the Central American rubber tree is concluded. Mr. Walter J. Turney describes some interesting experiments with ultra-violet light and the electric discharge.

A correspondent suggests to us that some one ought to invent a movable cellar step which, when trod upon, will turn off a switch and thus extinguish all electric lights. There are undoubtedly so many careless warehousemen, that a device of this character could be readily introduced.

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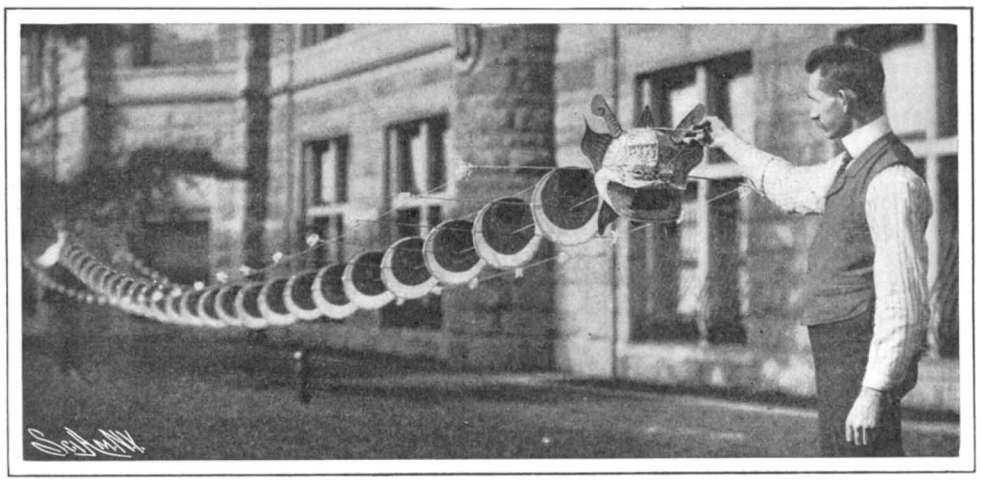
PICTURESQUE CHINESE KITES.

BY WALTER L. BEASLEY.

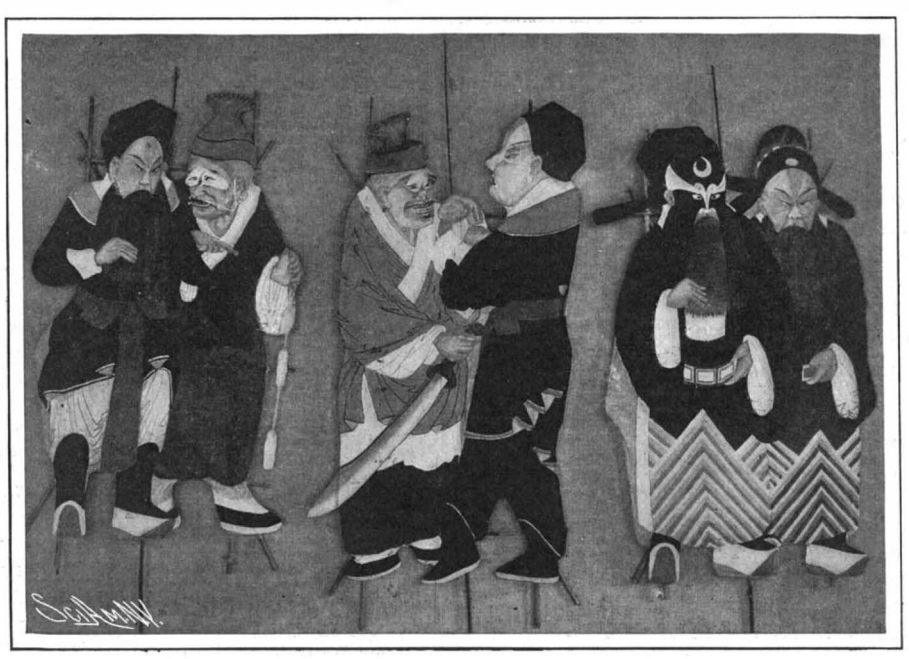
The new Chinese exhibition now being installed and arranged for early exhibition in the American Museum of Natural History, contains many novel and extremely interesting objects, quite new to the eyes of the Occident. To the liberality of Jacob H. Schiff, and a few other friends of the Museum, among them Mr. Morris K. Jesup, the present exhibit is due. The field work was intrusted to Dr. Berthold Laufer, who had previously carried on Eastern researches for the Museum among the Amur River tribes of Siberia and the island of Sakhalien in the Okotsk Sea. One portion of the collection is devoted to the popular amusements of the country. The most curious and striking specimens of this section are a varied series of picture kites, unusually picturesque in shape and ornamentation. The kites are wonderful specimens in their way, and portray a deal of ingenuity, especially their love of art and decoration, which runs through the whole life of the Chinese people, from their highest creations to the most commonplace objects of amusement. The kites were obtained in the vicinity of Peking, and they represent one of the leading outdoor diversions of the sons of both mandarins and nobles, as well as the native population. In China kite-flying is a national pastime. They are flown on certain holidays, one of the most popular being the festival of Ascending on High, occurring on the ninth day of the ninth month. On this occasion the hills and open country are lined with great processions of kite-fliers, both young and old, who devote the whole day to this sport. The universal use of the kite is not looked upon as a form of amusement alone, but has a sort of religious interest connected with it, and is regarded as symbolic of the human soul, which is likened unto a bird in flight. Each particular kite, therefore, has its meaning and conveys some emblematic idea. A story or legend is suggested, and some famous god or warrior's face is usually depicted. The likenesses of various animals and insects, more or less believed to be creatures of good luck rather than of evil portent, such as frogs, fishes, fireflies, owls, and butterflies, form the design of most of them. A great number, however, are constructed in double-like fashion, representing theatrical scenes and heroes of their ancient drama. Two of these portrait kites are shown in the accompanying illustrations. In most cases, excepting those of the women, the faces are covered with long-bearded, grotesque masks. A pair of boy-wrestlers in action and a typical Chinese maiden linked by the side of a figure having a ferocious animal head, evidently an Oriental version of Beauty and the Beast, form some of the curious shapes.

Probably the most wonderful and ingenious achievement of the Chinese kitemaker is the one designed to be a counterpart of the great Flying Dragon. This is unquestionably the longest and most fantastic amusement device that has ever been constructed for aerial flight. From head to tail it measures nearly forty feet, and is made to fold up, accordion-like. The fierce large head of the dragon, so famous in Chinese mythology, having long protruding horns, huge eyes, and gaping mouth, forms the front of the kite. Extending from head to end, and constituting the body portion, are a series of bamboo sticks, running crosswise, to the center of which are fastened twenty-five or more pasteboard disks, a foot in diameter. These are painted in circles of black, red, yellow, and white, representing the all-seeing eyes of the mighty dragon. A tail portion, of narrow silk strips, is arranged to the last piece of bamboo. By a mechanical contrivance, the curved pieces of pasteboard forming the eyes are made to revolve by the wind while the kite is being flown. Seen in the air, with its serpentine-like motion, its huge, glaring eyes, swiftly twirling in their sockets, the effect is said to be astonishingly realistic, producing an awe-inspiring scene, to the Chinese mind, at least, of the powerful demon of the Upper World. While being flown, a cord is attached to three or more points of its length, in order to keep it under control. In strong winds, several men are required to hold the reel. Undoubtedly we have here one of the first and most ancient patterns of flying-machines, thousands of years old, which modern investigators have utilized and brought to almost successful perfection. Dr. Stewart Cullen, of the Brooklyn Institute of Arts and Sciences, a recognized authority on games and amusements of the East, states that the first invention and origin of the kite is attributed to a Chinese general named Han Sin, who in the second century B. C., while engaged in besieging the fortifications of Kao Tsu, the founder of the Han dynasty, sent up a kite to measure the distance from his camp to the palace, which he had planned to enter by digging a tunnel, through which his army would come out about the center of the palace courtyard. Japan and Corea also imitate their Chinese neighbors in kite-flying, a custom which was probably borrowed and introduced from the latter country, though their kites are not nearly so artistic and fanciful in design as those of the Chinese. The Japanese are likewise ardent lovers of kite-flying, and come next to the Chinese in the variety of forms they employ. Certain days are set apart for kite-flying in Japan, varying in different localities. In one of the current stories of Japan a famous kite episode is recorded. In the sixteenth century a noted robber and bandit, Ishikawa Goemen, boldly tried to steal the celebrated Golden Fish surmounting the castle of Nagaya, by soaring up one stormy night by the aid of a large kite. Since then the flying of kites of an unusual size has been prohibited in the province of Owari. One of the peculiar sports which has been evolved out of kite-flying, and which is extensively practised in Japan and Corea, and to a limited degree in China, is that of kite-fighting. For this aerial warfare, silk cords or strings are used, which have been dipped their entire length in fish glue and a preparation of powdered glass or porcelain. The kites are sent up, and the moment the strings become crossed the battle begins. The manipulators must let out their lines, and the one that becomes tense is cut through at once. When half a dozen or more become entangled, the sport lasts nearly a day. Money is frequently wagered and special matches arranged by experts in kite-fighting. Besides the wide array of unique picture kites here shown and described, the new Chinese collection contains rich examples of the best *cloisonné* work. Numerous native paintings and drawings, illustrating their religious belief and worship, medical methods, the art of printing and bookmaking, together with a thousand or more volumes in Chinese script on all subjects, were obtained. When fully completed and installed the exhibit will be the largest and most comprehensive in this country, covering as it will nearly the whole range of Chinese life and industries. It is the ultimate hope and aim of the committee that the present collection should but mark the beginning of an exhaustive educational one, to be increased in the future by additions from all the other Asiatic countries, which would thoroughly represent the whole domain of their various cultures. The installing of such a collection, with its unequaled opportunities for practical research and study, would, it is thought, give an impetus to Columbia University which might lead to the establishment of an Oriental School, like those of London, Berlin, Leyden, St. Petersburg, and Paris, in which students could be trained for the diplomatic and consular service, and where business men, intending to locate in the Far East, could be made thoroughly acquainted with the products, needs, and commercial possibilities of these lands. The chair of Chinese recently inaugurated at Columbia, under Prof. Frederick Hirth, is the first successful step in this direction.



A Chinese Dragon Kite Forty Feet Long.

The Wrestlers—A Decorative Design on a Chinese Kite.



The Captive Maiden—A Scene Painted on a Chinese Kite.

PICTURESQUE CHINESE KITES.

STAFF—ITS USE AND TREATMENT.

BY J. S. CRAWFORD.

The crest of Art Hill in the Exposition grounds at St. Louis commands a view of the general Exposition buildings. These buildings are finished in staff. The pedestals, columns, capitals, pilasters, curtain-walls, friezes, pediments, arches, masks, figures, and statuary groups are molded of that material.

From the view above indicated the facades, architectural members and enrichments look like stone. They appear strong, solid, and permanent. This view from the hill has been designed to give the buildings perspective and emphasize their massiveness. The tints harmonize with stone colors. Like all pleasing constructions, the elevations are simple and stately; they please by the absence of fussy details; they impress by the restraints of dignity. Many times I have gone upon Art Hill with delegations in which were Congressmen, State officers, commissioners, and men high in the professions—all agree that strength, beauty, and dignity are the predominating features of these Exposition buildings.

Yet they are temporary. At best they are expected to last little more than a half-dozen years.

When I concluded to write this article on staff, it did not occur to

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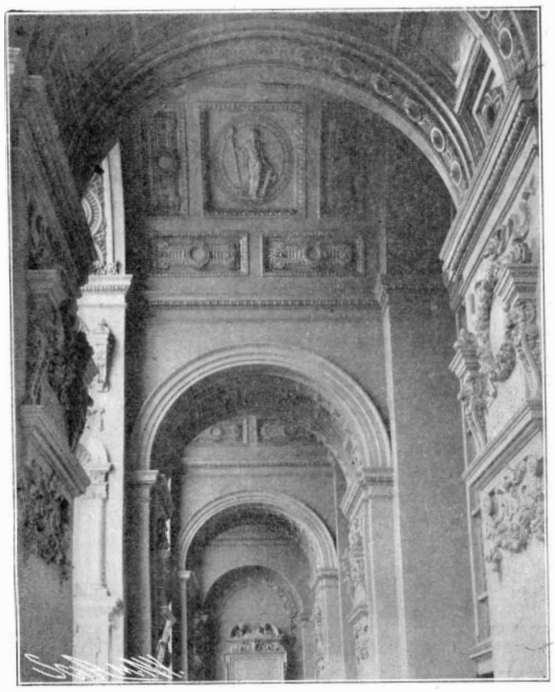
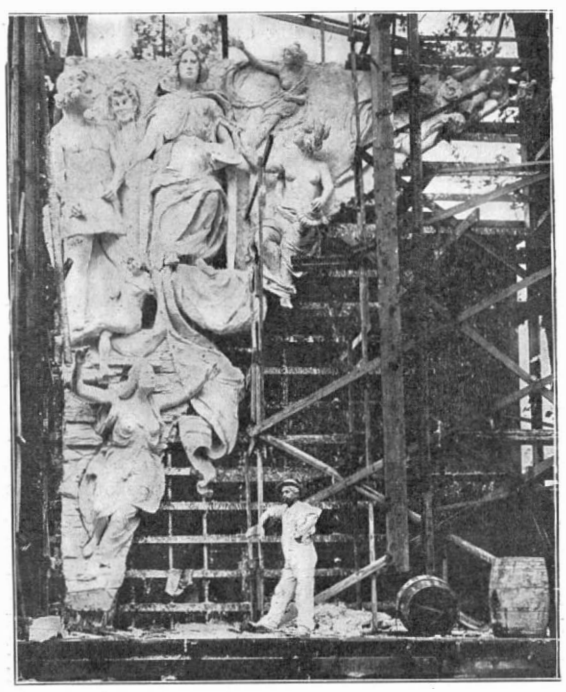
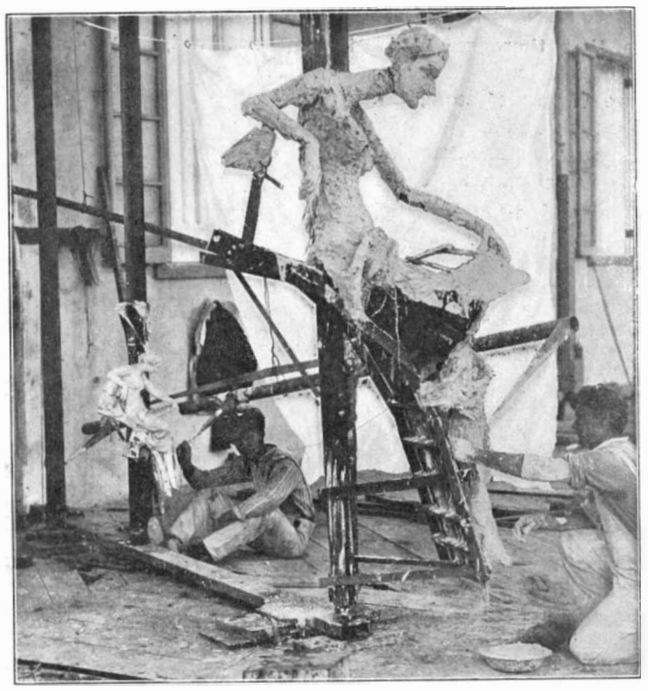


Detail of Portico.

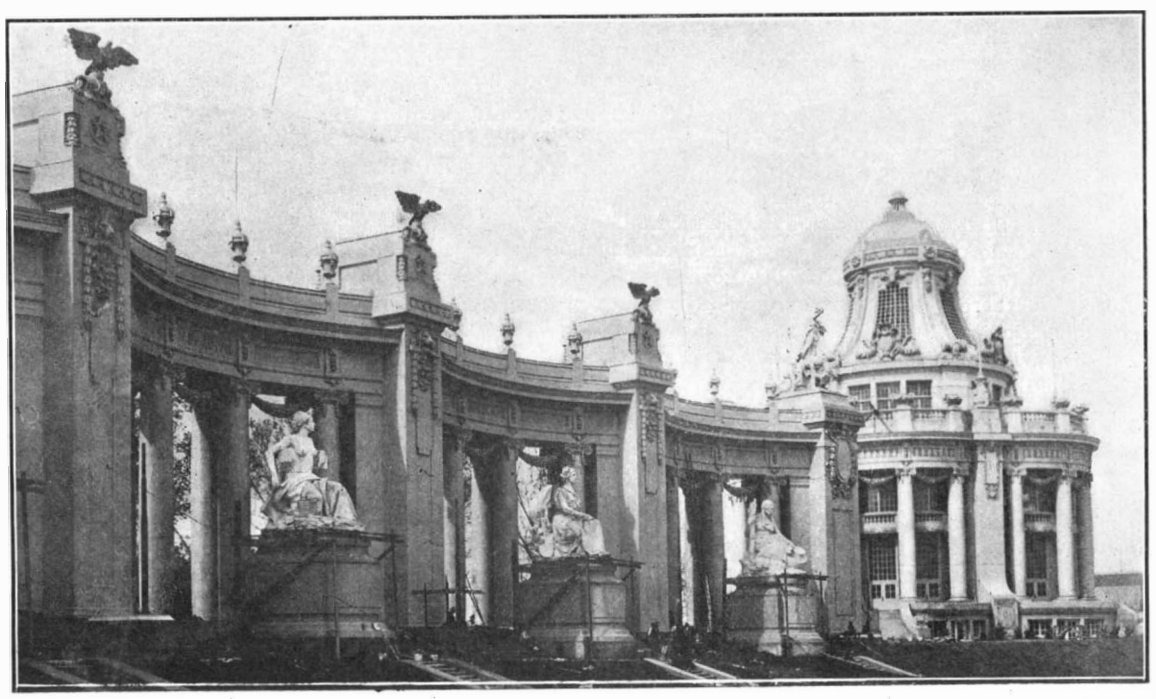


How Figures are Assembled and Spiked in Place.

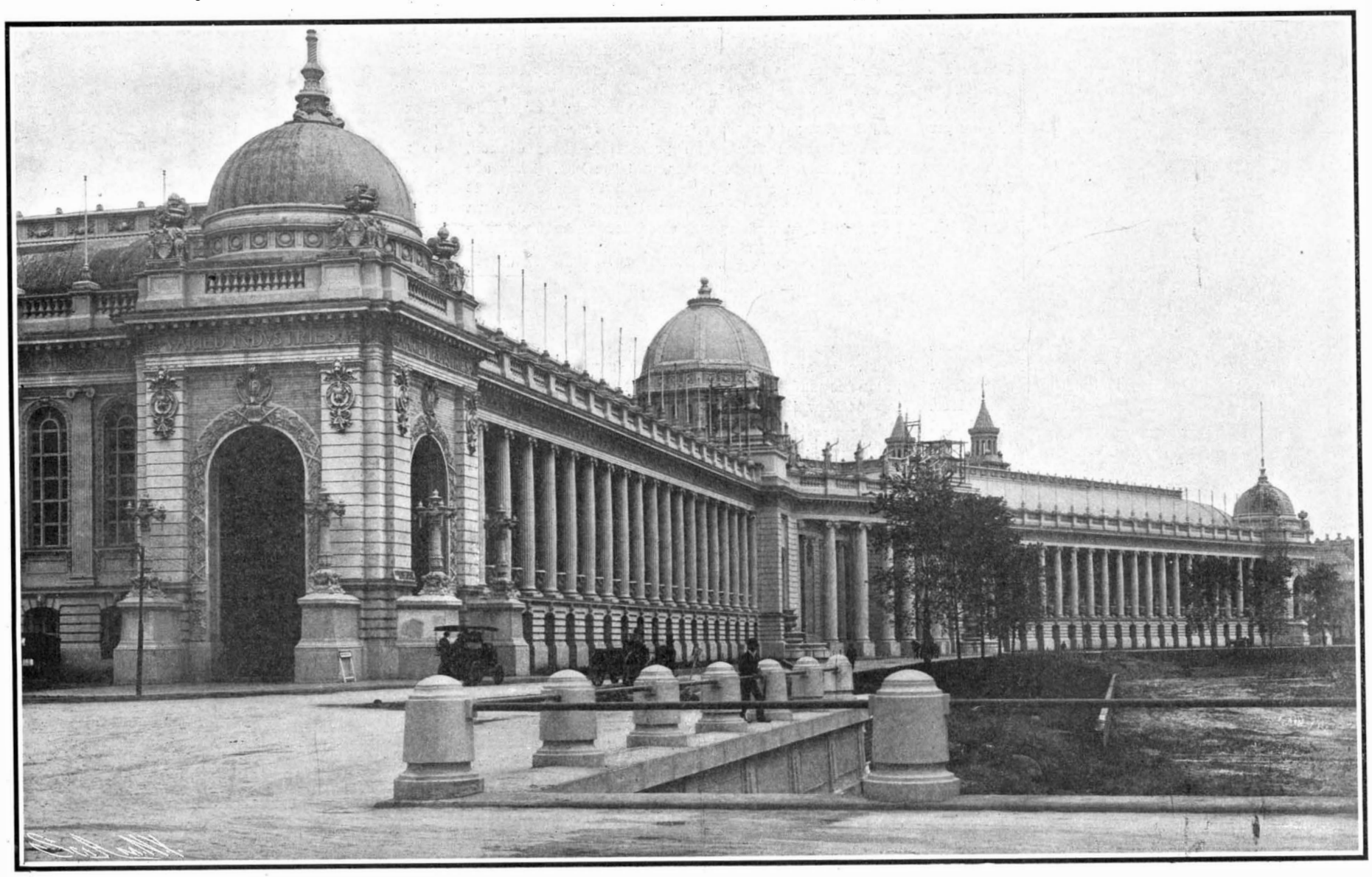


The Pointing Machine. Model to the Left, Artisan Setting Nails to the Pointer at the Right.

A Completed Figure Ready for Installation.



The Colonnade of Statues.



An Ionic Colonnade Veneered with Staff.

STAFF—ITS USE AND TREATMENT AT THE ST. LOUIS EXPOSITION.

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me that there would be the least difficulty in obtaining facts. Here were a half-dozen shops. Here were the contractors, the modelers, the molders, the installers and hangers; some had operated in staff at Chicago, Omaha, Paris, and Buffalo. But I soon found that their statements did not agree. Some said that Portland cement mixed with the staff made a composition stronger and better than staff alone; others said that cement and staff were incompatibles—that the mixture would not form adhesive plaster at all; some said that marble-dust was mixed with the best grades of staff; others never heard of marble dust. Most of the Italian workers claim to have secret processes for compounding the molds and releasing the cast from the mold; Americans claim that the best treatment is known alike to all skilled craftsmen in the art. Some said that the first staff was used on the Chicago Exposition buildings in 1893; others insisted that the ancients had plastered their houses very much in the way that St. Louis mechanics are doing to-day—that mummy-cases were made of staff. These staff-workers did not even agree as to the origin of the name. One pleasant fiction ran that W. D. Richardson, superintendent of staff-work at the Columbian Exposition, presented some specimens of his work to the chief architect of the Columbian Exposition buildings and the architect was so much pleased that he adopted Richardson's suggestion, saying: "This is the *staff* upon which we shall lean;" that the phrase was catching, and that the name crept into general use.

In the main these contradictions do not grow out of a purpose to deceive. The ndustry is so new in our country and its possibility so great that all sorts of theories have become current. No standards have been established and there are no printed American authorities. Staff workmen are enthusiastic and their imaginations do not always subserve their judgments.

Magazine writers have apparently overlooked the subject and there is scarcely anything in the elementary or periodical literature of the country treating of staff. William Millar, a London plasterer, printed a book in 1891 on "Plastering, Plain and Decorative," which furnishes some valuable subsidiary matter. This is the only English authority I could find. Watching the molding operations, however, I became able to reconcile a certain line of statements so that I ought to be able to give the essential facts relating to staff and its treatment.

Suppose that one hundred spread-eagles of colossal size are wanted. First, Missouri yellow clay is ground and tempered to the consistency of putty when ready for the glazier. The modeler shapes this clay in all details exactly as he wants the eagles. This work requires an artist. The model is kept free from cracks and toughened by moisture.

The next thing is to get a flexible mold which conforms in every particular to the details of the eagle. From this mold the one hundred birds will be cast. This mold is made of gelatin. It is one or two inches thick, cohesive, tough, and flexible. It is mobile, so that parts of the cast which cut under may be released. It may be bent and handled with little danger of breaking.

How shall we cast this mold?

First, overlay the model with a coat of clay one or two inches thick. Then overlay the coat of clay with a shell of plaster-of-Paris four or five inches thick. This "shell" may be cast in sections, or it may be cast whole and cut through to the overlay with a saw, then taken down in sections. The overlay of clay is then taken down; the model now stands alone. This model is oiled or greased. The inner surface of the shell is likewise oiled or greased, the shell replaced, and the sections keyed together and locked. The mold and model are held in their relative positions by a shore underneath and small posts called struts on the sides. There is now a vacant space between the shell and the model—the space before occupied by the clay. Through a small opening in the top this space is filled with ladles of melted gelatin, which soon sets. The shell is again taken down, the gelatin cut in sections coinciding with the shell and removed from the model. Each part is placed in its counterpart of the shell, and when these parts are approximated the mold is complete. The oil prevents the gelatin from sticking to either the shell or the mold. Alum water applied to the mold hardens its surface, causing the plaster to set more quickly.

From this mold twenty or twenty-five plaster-of-Paris eagles may be cast. As soon as the mold shows signs of weakening the gelatin is melted again and molded again. Ten eagles may be cast a day, and these casts ought to season two or three days before installation. So that giving time for making and renewing the molds it would be two weeks after the model is finished before the figures of these colossal birds would perch along the sky-line of a colonnade or building.

A discriminating mind will at once see the value of gelatin, which is a superior kind of glue, for molding ornamental figures. An intractable material such as wood or wax would not allow the "undercuts" to be withdrawn—no elaborate figure could be duplicated in the same mold. Gelatin (being tough, flexible, and mobile) cheapens, diversifies, and enriches the reliefs of the decoration.

The gelatin mold was invented by Mons. H. Vincent in London in 1850. The great exposition of 1851 popularized the process. Italians, always expert in terra cotta and the plastic arts, were quick to adopt it, and most of the men who follow exposition staff-work in this country are Italians. However, there is no special secret about the process of molding, and when a strike is threatened there is little difficulty in finding Americans or Germans who soon pick up the work. John Pianta, it is claimed, applied for a patent for a glue mold in the United States twenty-five years ago—a fact which no doubt tended to confirm Italians in the notion that they could monopolize the work. Some minor improvements have been introduced, such as using shellac to season and harden the surface of the clay model, stop the suction, and prevent adhesion. This gelatin searches out the minutest recesses in the model; it will reflect the grain in tanned skins and a day's growth of the human beard.

Of what are these eagles made?

Gypsum is the sulphate of lime. Gypsum rock is mined at Fort Dodge, Iowa; Blue Rapids, Kansas, and different points in Michigan. This rock is crushed and reduced in a grinder until it will pass through a burr-mill which reduces it to an impalpable flour. It is then cooked for two hours in kettles which hold eight or ten tons each. This cooking process gives it the chemical properties of stucco. The flour is commercially known as plaster-of-Paris. Out of this plaster alabaster is made.

A solution of glue retards the setting of mortar, giving the workmen more time to manipulate the plaster. A cast of simple plaster-of-Paris may be sawed, chiseled, whittled, and fitted, but it will not stand hammering or nailing. It will break and shatter. It is brittle and needs a binder.

Under the patronage of Owen Jones, the famous author of "The Grammar of Ornament," M. Leonard Alexander Desachy, a French modeler, in 1856, took out letters patent in London for a fibrous plaster. The Frenchman failed financially, but his method was so successful that at the Paris Exposition of 1878 panels forty feet square were shown made of fibrous plaster. This work for the first time was called "staff." The embellishments of the panel were called "*chassis-en-staff*." These panels were fastened with nails or screws; the enrichments were planted in the same manner. At this exposition some of the arches along the "Streets of All Nations" were made of staff. Where it was not possible to mold the sections *in situ*, they were nailed in place. Tow was used as a binder and the process gradually spread among engineers, mechanics, and workmen everywhere.

It is claimed that over 150,000 square yards of the fibrous plaster were used at the Columbian Exposition. For interior decoration it is as permanent as adamant. It is used to restore old ceilings; to build new centerpieces, pilasters, columns, medallions, running friezes and borders; to mold original and free-hand pieces, etc. It makes fine stage properties—great cannon, temples, images, stone ledges, and the like. They are cast around a core to make them light and cheap. It was used in the interior decoration of the new opera house in Paris, and a replica of Michael Angelo's "Moses" was made of staff in one of the Italian churches and transported to the museum in South Kensington.

The ordinary fibrous plaster is made of plaster-of-Paris and Manila fiber. Desachy used a coarse canvas called "scrim." At the Columbian Exposition burlap was largely used, at a cost of twelve cents a pound. In Mexico a species of cactus—the same from which pulque is made—furnishes a good fiber, and the coarse tow of New Zealand flax ranks high. I am told that some kinds of sea-grass and excelsior have been used successfully. This binder must be rather loose and coarse to allow the plaster to percolate and to give a surface for adhesion. It must be strong and well teased to give the cast uniform resistance. Mr. Joseph Eastman is perhaps the first contractor who used the unwoven fiber in this country, and Mr. Leo Bonet the first to exploit what is called staff-work in America.

Unmixed with fiber, a thin coating of mortar called "firsts" is first introduced into the mold to give a smooth, finished appearance. As soon as the firsts become tacky the "seconds" are introduced with relatively large quantities of fiber. Hundreds and hundreds of tons of this fiber from Manila have been used in the World's Fair buildings at St. Louis, at a cost not to exceed four cents a pound. Most of the casts are made in sections with open, unfinished backs. The mortar is banked against the mold as though the cast were hollow; strips of scantling with ends projecting are hanked in with the fiber and imbedded along the back of the cast. These ends make good handles for carrying the figures and the strips give additional strength to the work. Molders become very skilled in judging the amount of mortar necessary to fill one of these sections. I have frequently seen them gage the amount so exactly that not a quart of the material was left. And they appear to know just how fast to work the gaging before it becomes hard and refractory.

If it is sought to reinforce the fireproof qualities of staff English workmen introduce slag and breeze with the fiber. It seems that a few years ago a music hall in Oxford veneered with staff burned and gave the English architects an opportunity to determine the fire-resisting qualities of various retarding ingredients. Staff and slag stood the test.

Staff is splendidly adapted for all kinds of relief ornamentation. It readily adapts itself to arcs, ovals, scrolls, or irregular, free-hand figures. Its lines are not hard and studied like those of brick. They are soft, swimming, and pleasing.

Like the Bath stone in England, it may be put on in slabs to imitate heavy ashlars. Its cost is about one-third that of wood. The contract price of the Manufactures Building was $720,000; of that sum $165,000 was paid for the staff-work. This is a fair illustration of the proportional cost. The gelatin mold increased its production; the fiber increased its use.

Staff is well-nigh fireproof. Frost does not hurt it. Rain has little effect upon it. A drip injures it. Yet as a veneer for the ordinary Exposition building it lasts scarcely ten years. Why? Ordinarily these buildings have inadequate foundations. They settle and force cracks in the walls. Much of the plane surface is plastered on Burkitt-Hall sheeting, one-half inch pine, which costs about $16 a thousand. This sheeting is plowed with a tool like that used for matching flooring, the grooves running an inch or two apart. This sheeting swells in wet weather and shrinks in dry so that the clinches are broken and the plaster scales off. When anchored to brick buildings or spread on expanded lath, staff will doubtless prove to be a serviceable outside finish, easily repaired and moderate in cost. But its fitness for a permanent finish is just beginning to receive the attention of American builders. Before we shall know its real value we must await their verdict.

Besides the ornate decorations of the Exposition buildings done by the contractors, a half million dollars is being spent under the supervision of the Chief of Sculpture, Mr. Karl Bitter. In this department of the Fine Arts no less than six hunded groups and figures will be executed. Under methods prevailing twenty years ago it would have been impossible to do this work in the limited time or with twice the sum of money appropriated. One device alone, the pointing machine, has worked a saving of more than $300,000. This machine was invented by Mr. W. H. Pain and operates on the principle of the wood-carving frame used in the Pullman shops, and no doubt evolved from the pantograph. The model is, of course, made in the studio of the artist commissioned to produce it. This model is conveyed to an enlarging shop, of which there are two—one at Hoboken, N. J., and the other in the Education building. One arm of the pointing machine follows the reliefs of the model while the long arm indicates on a wooden frame the height of the corresponding relief on the enlarged work. Nails and slender spikes are driven into the frame just far enough to mark the height indicated by the pointer. Staff heavily bound with fiber is laid through this arrangement of nails until the heads are barely covered. With a little skill and practice the reliefs and surfaces of the original are enlarged to any size required. One group here known as the Center Cascades weighs over twenty tons and is built up in twenty sections. Many of these groups weigh five or six tons, and the statue of "Peace," by Karl Bitter, is a female figure sixteen feet high. The workmen in these enlarging shops get from 70 to 90 cents an hour.

Closely related to staff is pargeting—using a die on plastic ceilings to indent the ornamentation—a method which superseded hand-carved stucco.

Of course, molded work is cheaper and more diversified. But the relations of staff to the older methods of decoration is an interesting study, one upon which I shall not enter further than to say that plaster-of-Paris cannot be used with Portland cement. Miles of buildings in Paris and London are veneered and embellished with cement alone, but never in composition with staff; they are incompatibles.

One of the greatest enemies and causes of trouble to any first-class packing is water in cylinders, which, when it occurs, demoralizes the packing. Strange to say, no metallic packing has been designed which will give first-class results as a water packing—the water rods of pumps, for instance. When first applied they usually work with fair success, but soon commence to leak and continue doing so. Also no thoroughly satisfactory packing has been invented and used for expansion joints. There is quite a large field for investigation in this direction.

Charles T. Yerkes is the authority for the statement that the London underground system is now half completed, and that it will be entirely finished in about five years. The section from Baker Street to Waterloo will be open within a year.

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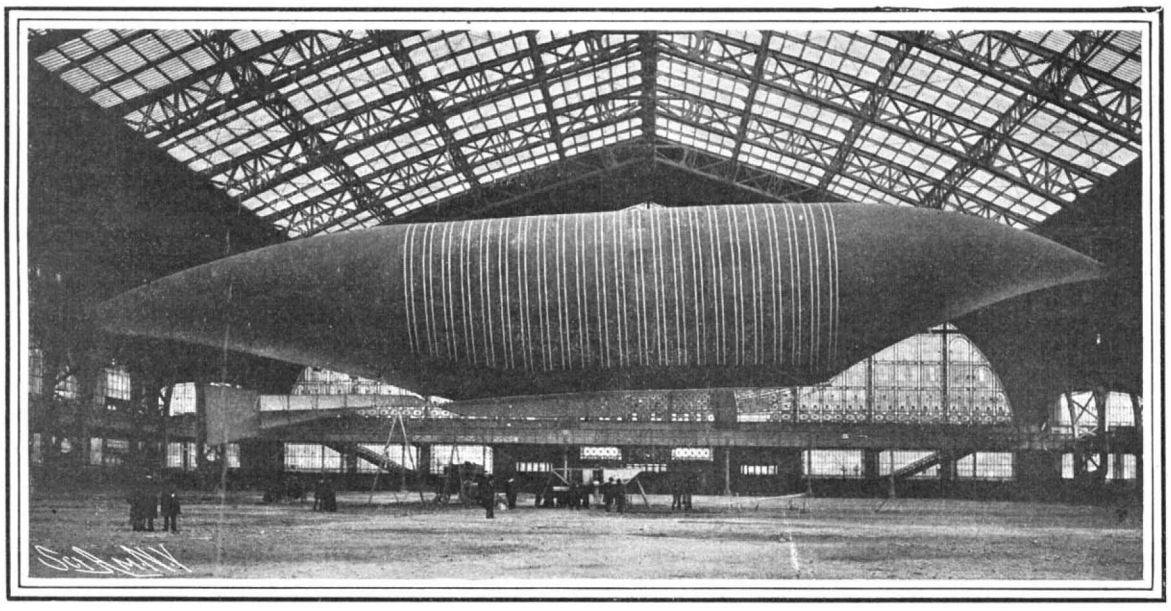
THE LEBAUDY AIRSHIP.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The remarkable flight which was made by the Lebaudy airship on the 12th of November will no doubt mark a date in the annals of aerial navigation. The most noteworthy performance was the circuit Moisson to Mantes and back, in which the airship covered about 38 miles in 1h. 41m. and came back to the starting point. It had been the intention of the aeronauts to make the trip to Paris as soon as they felt sufficient confidence in the airship's perfection, and they have now carried out their idea with complete success.

M. Juchmes, who piloted the airship, after an enthusiastic reception, stated that he left the balloon shed at 9:20 A. M. accompanied by the machinist, Rey. After passing over the Seine region to the west of Paris it crossed the Forest of St. Germain, then entered the city by way of the Bois de Boulogne. The airship was then headed direct for the Eiffel Tower, which it reached, and landed just behind it, carrying out his original intention. As the wind came somewhat from the side, he was obliged to hold the point of the balloon to the right of the course. At the start he had 640 pounds of ballast, and threw out 286 during the trip. The maximum altitude he reached was 1,000 feet, and the mean 330 feet. The duration of the trip was 1h. 41m. From Moisson to the Champ-de-Mars, the distance in a straight line is about 32 miles. He estimates that the actual distance he made is about 38 miles. As to the speed the airship made on this trip, it can be reckoned in two ways. Taking account of the straight-line distance, it is about 19 miles an hour, or according to the real distance covered by the airship, 22.4 miles an hour. The mean speed of the wind as registered at the top of the Eiffel Tower was 20 feet per second. It blew from the northwest. At the St. Jacques Tower, 200 feet high and therefore in the atmospheric layer in which the airship sailed (it kept generally 350 feet above the ground) the wind showed 10 feet a second, blowing from the west-southwest.



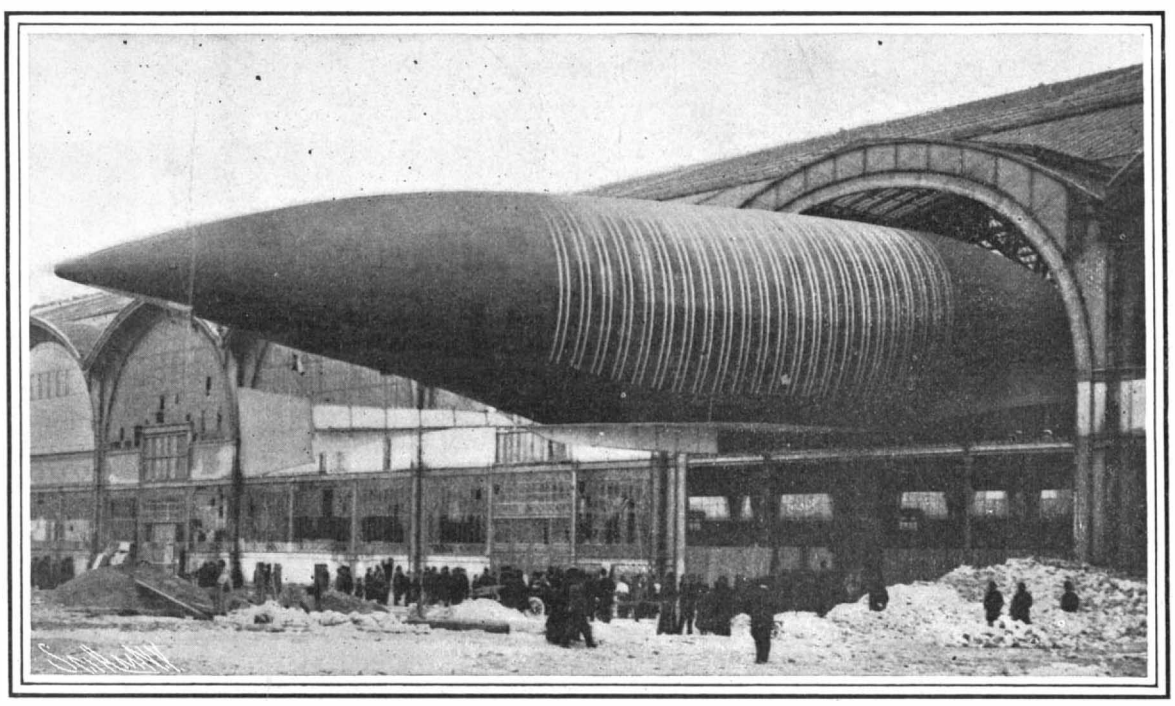
THE LEBAUDY AIRSHIP WITHIN THE MACHINERY HALL OF THE CHAMP-DE-MARS.

The balloon is asymmetrical, its midship frame being situated slightly toward the front. The total length being 190.24 feet. The midship frame is situated at 81.67 feet from the prow and 108.57 from the stern. The extreme diameter of the balloon is 32.14 feet. With respect to the length of 190.24 feet we have thus an elongation of 5.6 diameters. In the entire median part the section of the fusiform bag is not a complete circle, but a segment limited by a chord at its lower part. This means that the balloon presents a flat portion fixed to a linen-covered plane and held by a rigid frame which is attached to the side of the bag and, on another hand, supports the suspension.

The surface of the bag is about 13,000 square feet. Its weight, stitching included, is about 880 pounds. The impermeability is so complete that last fall the balloon remained inflated for more than forty days without the gas having perceptibly lost any of its ascensional force. The floating apparatus is completed by an air ballonet for compensating for the incessant variations in volume that the gas undergoes in consequence of the modifications in temperature and pressure. In the Lebaudy, the ballonet has a capacity of about 11,900 cubic feet, say about a seventh of the total capacity. It is divided into four compartments in order to prevent displacements of the mass of air. A blower of great discharge serving to inflate the ballonet is placed in the car and actuated normally by the gasoline motor that furnishes power to the propellers, but, in case of accident, may be set in operation by means of a small dynamo driven by accumulators.

A characteristic of the Lebaudy balloon is the presence of horizontal and vertical planes, the first of which concur toward limiting the pitching motions and the second assure the stability of the direction.

The car has the form of a flat-bottomed pontoon with pointed extremities. It is 15.75 feet in length, 5.25 in width and 3.28 in depth. It is formed of a metallic frame. In the experiments of 1902 it was entirely covered with aluminium, for which has now been substituted a fireproof fabric that covers only its prow. In order to stiffen all the parts of the car and firmly crossbrace the horizontal shaft of the propellers, there is arranged beneath the car a sort of crutch of pyramidal form composed of tubes and stretchers and the point of which serves for the attachment of the necessary rigging. It is through this pyramidal point that the balloon is placed upon the ground, and there is no need of a more solid base, since the landing of a dirigible does not necessitate an immediate disinflation. The car is suspended at about 10 feet beneath the oval frame by means of 28 small, flexible steel cables about 0.25 of an inch in diameter. We might be tempted to criticise the builders of the Lebaudy for having introduced into their suspension a rigid element called a "thrust frame," and which conflicts with the above principle. This is a piece of trapezoidal form, of well braced tubes, which starts obliquely from the car and ends in front of the oval frame and thus transmits to it directly, through compression, the thrust of the propeller . M. Julliot thinks that this frame, by rendering the car and balloon more completely interdependent, opposes itself to the effects of torsion that necessarily occur in turning about. At all events, the thrust frame is a new element that it was of interest to experiment with, and that seems to have given good results.



THE LEBAUDY AIRSHIP GLIDING OUT OF THE MACHINERY HALL OF THE CHAMP-DE-MARS

The motive power is furnished by a 40-horsepower Daimler motor cooled by a circulation of water and a radiator. The carbureting is of a system analogous to that of the Krebs apparatus. The gasoline tank is placed beneath the car and the motor as a measure of precaution against fire. A little compressed air is sent to it by means of a bicycle pump for feeding during the setting in operation. The exhaust pressure afterward suffices. The motor uses 30.8 pounds of gasoline per hour, say about 6 fluid ounces per horse hour.

The exhaust chamber likewise is placed under the car, between the forks of the pyramidal crutch. The mouth of the chimney is protected by a ball of wire gauze, which suffices to extinguish the projections of ignited gas. In order to prevent any ignition that might occur should drops of gasoline falling from the motor come into contact with the hot walls of the exhaust, the latter is protected by a sort of semi-cylindrical tunnel. It will be seen, then, that minutest precautions have been taken against the chances of fire.

The motor actuates two double-bladed propellers arranged on each side of the car at the extremities of a hollow horizontal journal in the interior of which revolves the driving shaft. The transmission to the propellers is effected through the intermedium of bevel wheels protected by casings. In consequence of their position it would be difficult to give the propellers a great sweep. Those now used are but 8 feet in diameter, but make up for so small dimensions by a high rotary velocity, say of from 800 to 1,000 revolutions a minute. The blades of the propellers are of steel plate of from 0.04 to 0.06 of an inch in thickness. The arm to which each blade is riveted and welded is formed of a hollow nickel-steel tube which becomes more and more oval and flattened in measure as it recedes from the center of rotation. Each blade occupies 1-16 of the circumference.

When the balloon is freshly inflated with hydrogen possessing about one ounce of ascensional force to the cubic foot, the carrying power is 5,848 pounds. The principal elements of the dead weight are as follows:

	Pounds.
Aerostatic part	1,056
Oval platform	660
Car, motor, propellers and mechanism	1,760
Total	3,476

There remain, then, 2,200 pounds disposable for carrying four aeronauts (660 pounds), 462 pounds of gasoline, representing a supply sufficient for a trip of 15 hours, 44 pounds of cooling water, 440 pounds of ballast, and a certain number of accessories, such as extinguishers, a statoscope indicating the ascending and descending motions, manometers indicating the pressure of the gas in the balloon, various cordage and two guide ropes in the front and rear.

In order to regulate the equilibrium and the distribution of the loads, so that the axis shall be perfectly horizontal, the builders have provided two small reservoirs of water at the two extremities of the oval platform. These communicate with each other through a flexible tube passing through the car and upon which is arranged a small pump by means of which water may be sent from one to the other.

An oil-propelled motor railroad coach is in course of construction for the Great Northern Railroad of Great Britain. The car is to be of the standard gage, with a capacity for 30 passengers. The motor will be of the Roots oil type, developing 40 horse power. Four speeds will be provided forward and reverse. There will be a cab fitted at either end of the vehicle for the accommodation of the engineer, so that the coach may be propelled either forward or backward and the engineer will always be at the front of the vehicle. The engines and propelling mechanism are being constructed by Sir W. G. Armstrong, Whitworth & Co., of Newcastle-on-Tyne, and the engine is to be available for various kinds of liquid fuel, such as ordinary petroleum oil, gasoline, paraffin or kerosene. In the first car, attention will not be devoted so much to speed as to reliability and efficiency in the motor. The top speed will not be greater than 35 miles per hour.

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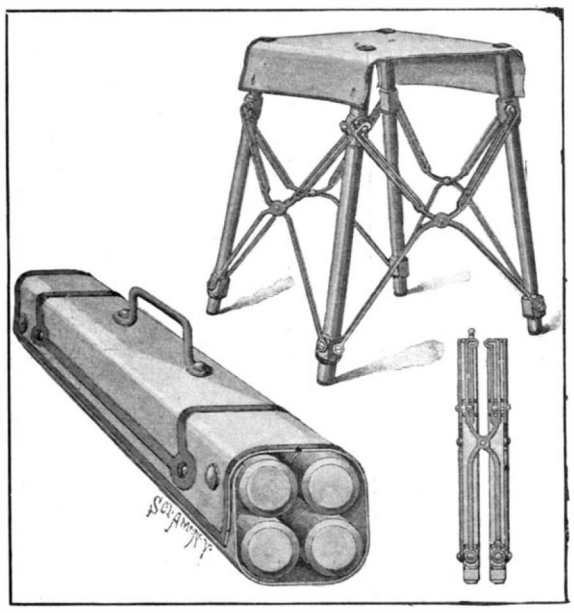
Patent Department

FOLDABLE SEAT.

In the accompanying illustration we show a folding stool of improved form, which has just been patented

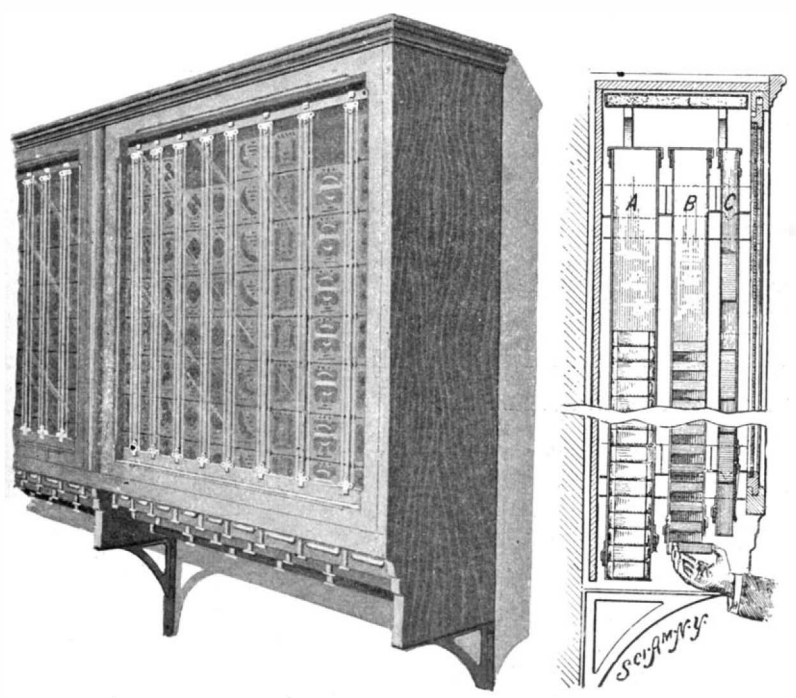


FOLDABLE SEAT.

by Mr. James Sharkey, of Eton, Ohio. An essential feature of this improved stool lies in the provision of means for automatically locking the stool in open position, so as to afford a stable support whereon the seat top may be conveniently held for service. As shown in the illustration, the four legs of the stool are provided with flattened surfaces near the upper and lower ends, on which wear plates are fastened so as to slightly project outward from the surfaces of the legs and serve as clearance washers. To each pair of legs a foldable brace is secured. This consists of two arms crossed and pivoted at their centers. Their lower ends are pivoted to the clearance plates of the stool legs. The upper portions of the arms are slotted, and pivotally secured to the upper clearance plates by screws fastened to these slots. These slots permit folding of the stool, when the parts will occupy the positions shown in one of our views. When in open position, the stool is automatically locked in place because of the lateral bend which will be observed at the upper ends of the arm. This obviously prevents accidental folding and holds the legs from drawing together under the weight of a person sitting on the stool. The canvas top of the stool is provided with four circular openings, which may be readily slipped over buttons formed on the tops of the legs. When the legs are folded, the canvas top may be wrapped around the frame and its ends buttoned together. A handle is also secured to the cover, so that the folded stool forms a neat package, which may be very conveniently carried about. The invention is, of course, not limited to the purpose just described. It may be elongated and modified so as to serve as a support for a foldable top, a table, a field camera, and any other analogous purpose.

DISPLAY AND VENDING CASE.

An attractive display of his goods means so much to a merchant, that novel and pleasing display cabinets are constantly being designed by inventors. We illustrate herewith a recent invention, which is particularly applicable to the display of small articles, such as tobacco packages of different sizes. The invention has been patented by Mr. William Meyer, of 120 Summit Avenue, West Hoboken, N. J. The packages are stored in three different magazines according to size. The magazines lie one in front of the other, and are divided into compartments by rails of I-shaped cross section. These are vertically arranged, and are adapted to retain the articles between their flanges. Magazine A is provided with narrow compartments; those in magazine B are wider and deeper, while the largest compartments are found in magazine C. It will be observed in the sectional view that at the lower or delivery ends of the compartments the flanges are cut away at the front, and that the delivery ends of magazine C project below those of magazine B, which in turn project below those of magazine A, so that access may be easily had to any one of them from the front. In order to prevent the packages from sliding out at the bottom, foot-flanges are provided on the lower ends of the side pieces. The delivery points of magazine A are covered by spring-pressed plates to prevent the lowest articles from sliding forward. In order to make the appearance of the display case more attractive, the front flanges of the side pieces are cut away throughout their length, and vertical rods substituted to hold the packages in place. The magazines are supported in the cabinet in such manner that they may be slid forward when it is desired to remove them therefrom. The entire front of the cabinet except the lower or delivery portion is covered by glass doors, which are fitted in grooves at the top and bottom of the case. The upper groove is made so deep, that on raising the glass door therein the lower end of the door will be raised clear of its groove, and the door can thus be removed. At the top of the cabinet is a receptacle filled with moistened absorbent material, which serves to preserve a proper degree of moisture in the articles contained in the magazine.

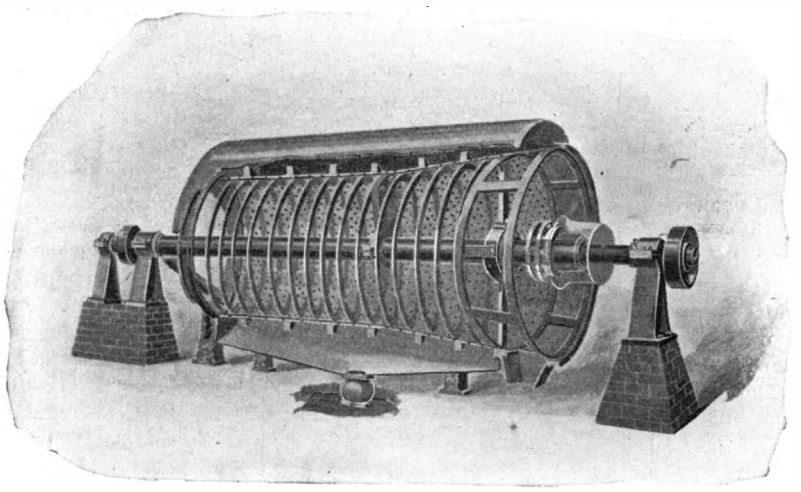


DISPLAY AND VENDING CASE.

CENTRIFUGAL MACHINE.

An improved machine has recently been invented by Mr. Paul Boulanger, Obrapia 48, Havana, Cuba, for straining out the liquid portions of pulp in sugar-making. The machine may be briefly described as consisting of an outer stationary casing in which is located a revoluble perforated drum, and operating within this drum is a spiral conveyer independently revoluble. In the accompanying illustration the outer casing has been broken away to show the perforated drum and the conveyer. The ends of the casing are closed by flanges, which fit closely to the surface of the drum. An outlet is, however, provided at the bottom, through which the liquid may be drawn off. The drum, it will be observed, is flared from the center to the right-hand end, where it is supported by spokes radiating from the central hub. Here it is also coupled to a skeleton frame, consisting of a cylinder section in which large openings have been cut. A separate casing covers this frame, and is provided with an outlet at the bottom; the frame is secured to a disk provided with a hub keyed to the main driving shaft. The latter is supported in bearings at each end of the machine, and is provided with a pulley at the right end, by which it may be rotated. The rotation of this shaft causes the perforated drum to rotate, the left-hand end of the drum being supported by a ring which turns on roller bearings mounted in a circular frame. The conveyer consists of a spirally-coiled metal strip, which, at the center, is supported by an arm extending from a central hub. This hub is keyed to a hollow shaft, which is slipped over the main driving shaft, and is supported in a separate bearing at the left end of the machine and in a central recess in the hub of the disk at the right end. This shaft may be rotated by connection with a pulley mounted thereon at the left end. By this construction it will be observed that the conveyer and perforated drum may be separately rotated and controlled.

The pulp may be fed into the machine through a tube at the left, and by centrifugal action will be thrown against the perforated wall of the drum, the liquid matter passing through the perforations into the casing, whence it may be drawn off through the bottom outlet. The solid matter, however, is retained and fed forward by the conveyer until it reaches the skeleton frame, through the openings of which it passes into the auxiliary casing, and may be thence drawn off through the outlet provided therefor.



CENTRIFUGAL MACHINE.

An Early Conception of the Telephone.

The supposed inventors of the telephone are so many, and their number is so constantly increasing, that the claims of a certain Charles Bourseul, whose electric telephone was described in French and German periodicals in 1854, may not be without interest. In a German daily newspaper which bears the strange title Didas-Kalia, of Frankfort-on-the-Main, there appears in the issue for September 28, 1854, a rather fantastic description of the wonderful achievements of Bourseul. After rhapsodizing on the "wonders with which electricity has lately surprised us," the author mentions a new invention "which will not only revolutionize telegraphy, but will also immeasurably extend its usefulness." The invention in question, we are told, is nothing more or less than the electric transmission of speech, and springs from the fertile brain of Charles Bourseul, a soldier of the army of Africa in 1848.

It must be confessed that Bourseul had the right idea. An electric current passing through a wire energizes a piece of wrought iron with which it is in contact, and converts it into a magnet. As soon as the circuit is broken, the wrought iron is demagnetized. The electro-magnet thus constituted is able alternately to attract and release a movable plate, which, by its coming and going, produces the conventional signs used in telegraphy. Bourseul thought that if a metallic disk could be invented which would be so movable and flexible as to respond to all the vibrations of sounds (as does air), and that if this disk were placed in a circuit so that it could make and break the current at every impact of the air vibrations, it would by the same means be possible to cause a second similar metallic disk to repeat the vibrations in the first disk in equal time. Hence, the ear placed at the second disk would be affected as if it received the sounds directly.

The author of the article is so imbued with the possibilities of Bourseul's invention that he informs us, "if the idea is carried into effect, then the electric telegraph will be of the past."

It is, indeed, clear enough that Bourseul had the telephone in his grasp not only before Bell, but even seven years before Philip Reis produced his famous make-and-break musical telephone at Frankfort. Bourseul, however, seems not to have gone so far as to produce a working instrument adapted for actual use. Furthermore, he probably knew nothing at all of the undulatory theory of the current, upon which articulate speech depends. For that reason the courts have ignored Bourseul's apparent claims to originality in the production of the telephone. Bourseul's case is rather striking, for it is the case of a man who had to make but one short step in order to realize an idea, which, only many years later, was practically carried out.

About forty deaf-and-dumb persons gathered recently at the house of William E. Shaw, an electrical worker living in Brookline, Boston, Mass., to witness a demonstration of a new invention which has been worked out by Mr. Shaw. It is an alarm clock designed to awaken persons who have the misfortune to be deaf and dumb. Its function is performed in several different ways. At the time for which the instrument is set, an electric light is thrown into operation, and the rays are reflected on the face of the sleeper, and besides this there is an arrangement by which the pillow under the head of the sleeper is violently agitated. The inventor says that he does not expect to make any money out of the device, as there cannot be sufficient demand for it, but he invented the thing more out of compassion for persons afflicted in this unfortunate manner than for any hope of reward.

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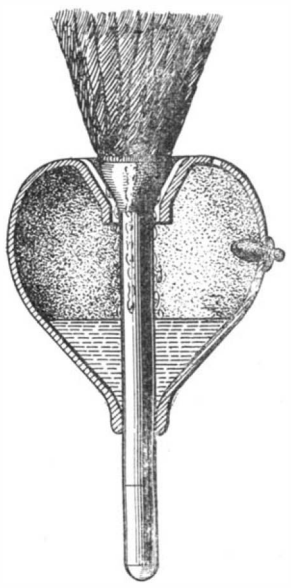
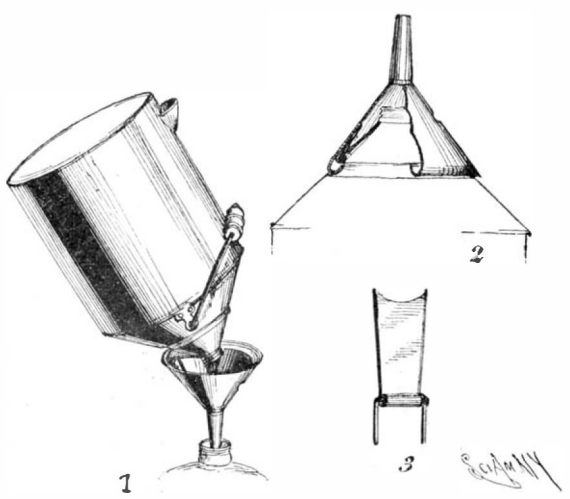
ODDITIES IN INVENTIONS.

DRIP-RECEIVER FOR UMBRELLAS.—An Ohio inventor has hit upon a very simple device which can be attached to a wet umbrella to catch the drip. It consists of a rubber receptacle having approximately the shape of a top. The lower end of the receptacle is provided with a small opening which will snugly fit over the slenderest umbrella rod; yet the material is sufficiently elastic to permit of its being stretched over the largest rod ordinarily used. At the upper end of the device is a much larger opening formed with an inwardly extending flange which serves to retain the dripping even though the umbrella be raised for use. In order to keep this flange clear of the umbrella, it has a number of ribs formed therein. An opening is formed in the side of the receptacle, through which the water collected may be removed. This opening is normally closed with a rubber plug.



DRIP-RECEIVER FOR UMBRELLAS.

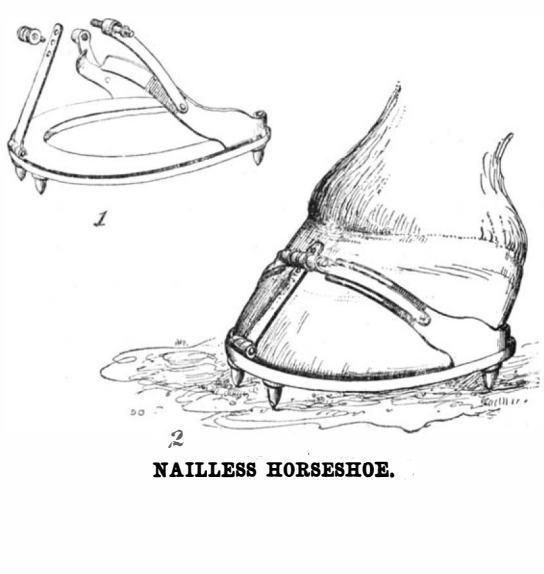
AN IMPROVED OIL CAN.—A recent invention provides an oil can and funnel which may be used in filling lamps or for other purposes in such manner as to prevent waste of oil. The funnel is attached to the can by a hinge, such as shown in Fig. 3. Normally,



AN IMPROVED QIL CAN.

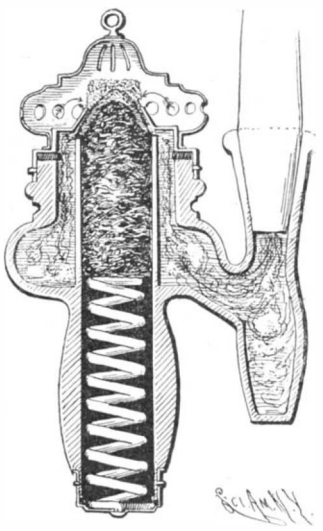
the funnel covers the top of the can, as shown in Fig. 2; but when it is desired to fill a lamp or the like, the funnel may be swung to the position shown in Fig. 1. It will be observed that on the line where the funnel rests on the top of the can, a groove is formed; also from Fig. 2 it will be observed that the edge of the funnel at the mouth is turned over, forming a trough. When the funnel occupies the position shown in Fig. 2, any drippings from the can or funnel will be caught in this trough and retained until poured out on filling of the next lamp. A slight projection on the inner face of the funnel is adapted to catch on the mouth of the can and hold the edge of the trough in snug engagement with the upper edge of the groove on the can.

NAILLESS HORSESHOE.—As a substitute for the ordinary nailed horseshoe a Pennsylvanian has invented a shoe which can be applied very readily and secured by means of a single bolt. The shoe consists of a plate of horseshoe form provided with heel and toe calks. Pivoted to the upper face of the plate, at the heel ends, are two draw-straps made to fit the contour of the hoof. Tongue-straps are pivoted to these draw-straps, and are provided with lugs at their ends to receive the clamping bolt. A toe-strip pivotally attached to the toe of the horseshoe extends upward to meet the tongue-straps. Openings provided in this toe-strip are adapted to receive a projection formed on a sleeve lying between the ends of the lugs on the tongue-straps. This projection serves to hold the straps from working downward. In placing the shoe on the horse's hoof, the straps may be quickly swung in position, and secured by means of the bolt.



NAILLESS HORSESHOE.

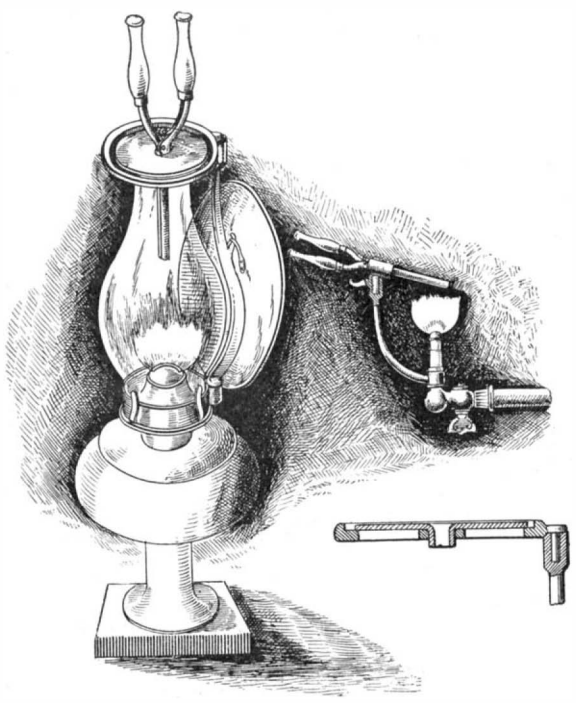
IMPROVED TOBACCO PIPE.—Advantages claimed for the recently patented tobacco pipe illustrated herewith, are that it provides means whereby the burning portion of the tobacco is always left exposed to the air, that the unused tobacco is kept fresh and pure, that it will retain fire as long as a cigar, thus doing away with the tedious continuous sucking usually required, and that it automatically controls the feed of tobacco to the zone of combustion. The bowl of the pipe is formed with a central bore or tube, around the upper end of which is an annular chamber connected at one side with the pipe stem. The tobacco in the shape of a plug is inserted in the tube, and is pressed upward against a burner head by a coil spring. The burner head is attached to the mouth of the bowl, and over it is placed a cover piece. On lighting the tobacco, only that part projecting above the burner head will burn, but the adjacent portion of the plug becomes gradually plastic under the combined action of the heat and the moisture in the tobacco, so that the spring is enabled to force it up slowly to the zone of combustion. The ashes formed are collected in the pipe-cover.



IMPROVED TOBACCO PIPE.

It is claimed that by this arrangement, even if the pipe should go out a number of times, the flavor of the tobacco would remain the same as that of a freshly charged pipe.

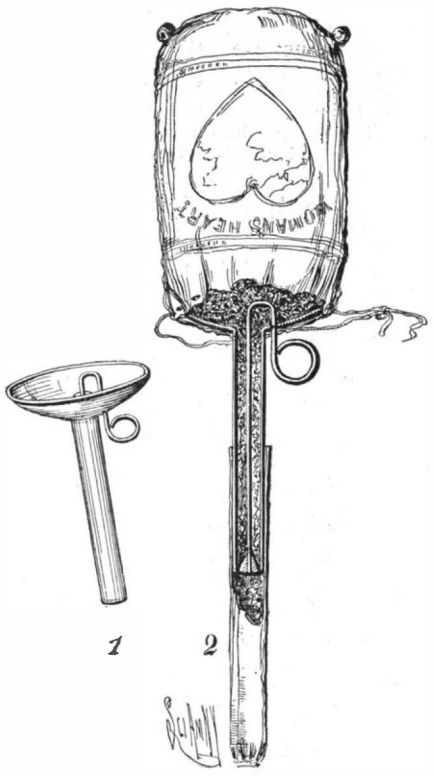
HEATING ATTACHMENT FOR LAMPS OR GAS BURNERS.—A lady in Chicago has recently invented an attachment for lamps or gas burners, which may be used to support any desired article above the flame, making use of its heat without detracting from its luminosity. The device may be easily attached to or removed from the lamp and packed in a small compass, so that it will be found very useful for travelers. As designed for a lamp, the device comprises a base ring which fits upon the lamp burner. The ring carries an upright arm formed with a socket at the top, which is adapted to receive the supporting pin of a spider. The spider is thus held centrally over the chimney to support a cup



HEATING ATTACHMENT FOR LAMPS OR GAS BURNERS.

or other receptacle for heating liquids. A disk is also furnished, and this placed on a spider serves as a deflecting plate. A curling iron may be heated by placing the end through the central opening in the disk. The gas attachment differs mainly in the form of the supporting arm, which is much shorter and is provided with a socket at the bottom which fits over the burner. A separate support is provided for curling irons, consisting of a short tubular section with a pin to fit into the socket at the top of the supporting arm.

CIGARETTE FORMER.—A simple little device for forming cigarettes is shown in the accompanying illustration. It may be conveniently fastened to the ordinary package of tobacco, to which it may remain attached until the tobacco is exhausted. It comprises an oval shaped cup and a stem of either circular or oval cross-section depending upon the form of cigarette desired. The cup is slipped into the mouth of the



CIGARETTE FORMER.

tobacco pouch and fastened therein by the shirring string of the pouch.

In use the cigarette paper is wrapped about the projecting stem of the device and the pouch inverted so that the tobacco will flow into the paper. A plunger is arranged in the stem, and may be operated to govern the flow, and also to pack the tobacco in the paper tube, which is slowly drawn off the stem as it becomes filled.

Brief Notes Concerning Patents.

An improvement in air brakes which is covered by sixteen patents has been devised by W. V. Turner, air brake inspector, and George R. Henderson, superintendent of motive power of the Santa Fé system. A great feature of the innovation, according to the inventors, is that it is possible to recharge the brakes on a train while the brakes are set, thus making it impossible for a train on a grade to start and run away while the brakes are being reset. It will do away with the creeping, due to the leakage on a train line, and will maintain a uniform pressure on all the reservoirs of a line, preventing the possibility of a train's breaking in two. A train set with this brake will remain any length of time on a grade without any danger of moving. It requires only about two-thirds as much air as the best brakes now in use, and is said also to effect a great saving in pumps.

Col. U. R. Brooks, clerk of the Supreme Court of the State of South Carolina, is at the head of the Brooks Improved Steam Valve Company, with headquarters at Columbia, S. C. The device made by the company, it is claimed, decreases the steam consumption of a locomotive and at the same time increases the speed of the engine. The invention is that of a man who has been for sixteen years employed at the shops of the Southern Railroad Company, and whose name is for certain reasons withheld. The device has been recently called to the attention of a number of railroad men, who have become much interested because of some very novel features introduced, and a locomotive is being equipped with it, for the purpose of subjecting the valve to the severest tests, in order to determine exactly what the value of the invention may be.

There are said to be about fifty thousand square miles of land in this country covered with bituminous shale, for an average depth of thirty feet, for which there is little or no use, and a patent has been recently granted to Otto Oppelt, a chemist of New Albany, Ky., covering a process by which a good quality of gas and oil can be made from this deposit at a cost far below that of gas at present. These shales abound around Louisville, and in some places deposits are one hundred feet in thickness. It is proposed to erect a plant at once, and supply gas for industrial use to firms in Louisville. This business alone could be profitably engaged in, but another considerable source of income will be derived from the sale of the by-products, consisting of silicate and sulphate of alumina, ammonia, sulphate of iron, paraffine, and phosphoric acid.

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RECENTLY PATENTED INVENTIONS.

Electrical Devices.

SAFETY-ALARM DEVICE FOR MARINE VESSELS.—M. SHEPARD, Edgartown, Mass. The main feature of this improvement is a ball-bearing rod projecting below the hull. When the rod's lower end contacts with the bottom, the pressure against it is increased above the pressure required to hold the rod vertically at other times. This increase gives movement to the rod which makes an electric circuit and sounds an alarm upon the vessel. The circuit closing arrangement and spring setting device are in a cylinder within the hull which carries at its lower end the ball and rod. These parts and the alarm constitute the apparatus which is telescoped into a cylinder and valve secured to, and opening through the hull for safeguarding purposes.

ELECTRIC PROGRAM-CLOCK. — J. W. PORTIS, Buies Creek, N. C. The invention is in the nature of a signaling clock designed to ring vibrating electrical bells at various points and at various intervals for schools, colleges, factories, and such other institutions where a daily program is necessary. The device has three or more automatic circuit-switches, to one of which is connected by wires a large electric bell. From other switches lines run to which bells are attached in various rooms. These are all operated from one battery and this battery-circuit is never closed except while ringing signals on one of the lines.

MINIATURE TELEGRAPHIC INSTRUMENT.—B. I. LEVI, New York, N. Y. In the sounder for this instrument is the combination of a board with screw-holes and countersinks, a sounder mechanism with a base-plate and supports for a movable armature, screws engaging the base-plates and supports for holding them together, the screws with heads normally engaging both the board and base-plate so as to space them apart, and screws engaging the board and base-plate, the screws with heads engaging the countersinks upon the under side of the boards and connecting the board and base-plates together so as to exert pressure upon the screw heads.

Engineering Improvements.

ROTARY ENGINE.—M. A. RICE, Los Angeles, Cal. The object of this invention is to provide a rotary engine which is arranged to insure easy running, to allow of cutting off the motive agent at any desired point; to permit reversing the engine, to prevent endwise thrust of the piston in the cylinder and to utilize the motive agent expansively to the fullest advantage.

PARALLEL ROD FOR LOCOMOTIVES.—C. HOUSTON, Benson, Ariz. The object in this improvement is to provide a parallel rod for locomotives, arranged to insure a direct transmission of the power from the piston to the front and rear driving-wheels and to avoid over-heating of the pivotal connection between the main rod and the parallel rod.

Heating and Lighting.

SPREADER FOR OIL-BURNERS.—H. P. AKERS, Crisman, Indiana. The present invention refers to railroad signal lamps and the like; and the object is to provide a spreader for oil-burners which is simple and durable in construction, very economical in the use of oil, and arranged to properly spread the flame without causing smoke and without allowing dirt to accumulate in the spreader.

SAFETY-LAMP.—G. W. REILLY and C. A. PHILLIP, Wichita, Kan. The invention is an improvement in that class of lamps which are adapted for burning hydrocarbon oils and are provided with a chamber adapted to contain a substance which is non-combustible and which will serve in case the lamp is broken to extinguish the fire due to ignition of the oil. The glass lamp chamber is provided with a horizontal partition formed integrally with and also made thinner than the chamber or body, and thus made easily frangible.

Machines and Mechanical Devices.

LOOM.—E. VAHLE, West Hoboken, N. J. The object of the improvement is to provide a loom for weaving all kinds of textile fabrics and arranged to carry double-up weft-thread through the open shed by a spoolless shuttle, to produce a fabric having double weft-threads in each pick, the arrangement permitting the production of plain goods as well as figured goods with the aid of a jacquard.

BEARING FOR DREDGING-MACHINE.—P. SMALL, Oroville, Cal. In this instance the purpose is to provide a bearing for dredging-machines, more particularly a bearing for the shaft on the free end of the beam, the arrangement being such that any sand passing into the bearing during the dredging operation is quickly and continually washed out to prevent the same from cutting into the bearing to the detriment of the proper working of the apparatus.

WINDMILL-PUMP COUPLING.—C. W. DECKER, Charles City, Iowa. In this patent the invention is in the nature of an improved windmill-pump coupling. The object is to make it possible to throw the pump-handle in gear and the windmill out of gear, or vice versa, by means of the hand-lever alone, the same being intended to provide a pump which can be made at small cost and great simplicity of parts.

Of Interest to Farmers.

PINDAL-PLANTER.—A. TYLER, Quitman, Ga. Mr. Tyler's object in this case is to provide a machine of simple and durable construction which while especially adapted for planting the pindal or peanut will reliably deposit in the ground all kinds of seeds and the like ordinarily planted in hills separated a predetermined distance from each other.

ANIMAL-CRATE.—W. A. STEWART, Wolcottville, Ind. In this invention the object in view is to provide a construction which may be used to contain a number of animals, such as hogs or pigs, the crate being equipped with a tray in which one animal at a time may be laid and held in a position convenient for operation, such as pulling a tusk from the mouth of a hog.

HARROW.—S. PREJEAN and G. C. BELLOCQ, Belle Alliance, La. The purpose of this invention is the provision of a harrow which will have a wheeled support to and from the field and during operation and means whereby it can be kept in one position while rotating relative to the rows between which cultivation is to be effected. In operation the harrow will not jump from side to side, as is customary in ordinary harrows. This relieves the team from unnecessary encumbrance and enables it to direct all energy to the draft of the machine.

Pertaining to Vehicles.

BICYCLE-SUPPORT.—M. HENOCH, Laporte, Ind. This improvement has particular application to a portable support to be attached to the front of the machine. The majority of supports which support the wheel upright at four points tends to permit the wheel to rock when placed upon uneven surfaces, thereby presenting an inclination toward the overturning of the wheel when the support receives a jar or shock; but by elevating the front wheel slightly from the ground and providing a three-point support formed by the two arms of this device and the rear wheel the tendency to overturn is obviated.

Miscellaneous.

EYEGLASSES.—W. H. WEASER, Pittsfield, Mass. In this case the object is to provide new and improved eyeglasses arranged to insure a firm connection between the bow-spring, the nose-guards, and the studs; to prevent loosening of the bow-spring or nose-guard, and to allow of adjusting the lenses up or down relative to the nose-guards.

SPUR ATTACHMENT FOR STIRRUPS.—C. L. POORTER, Marshall, Tex. In this construction a body-bar having an offset carrying a rowel is so hinged at its forward end to the stirrup that when the latter is not in use the bar will hang perpendicularly downward, but when the foot is placed in the stirrup the bar will be brought to a horizontal position, the offset carrying the rowel fitting snugly to the rear of the boot heel, enabling the spur to be as conveniently brought into action as if the spur were attached to the boot as ordinarily, but leaving the boot free from the spur at the moment of dismounting.

FAN ATTACHMENT FOR SEWING-MACHINES.—O. G. OGDEN, Louisville, Ky. In this case the object is to provide a construction by which the fan attachment can be readily connected with and disconnected from the fly-wheel of the machine and to so construct the fan-supporting devices and the connecting means for securing the same to the fly-wheel that these means may be adjusted to one side or the other of the fly-wheel and can be turned in the knockdown position of the parts to secure a compact arrangement for shipment or storage.

CANDLESTICK.—W. NICOL, 52 Tay Street, and J. H. STEWART, 47 Tay Street, Invercargill, New Zealand. The invention refers to candlesticks, its object being to provide one that candles of any size may be held equally firm in the holder or socket, the candle easily raised as it burns down that almost the whole may be burned, and the spring fixed from the side of the bowl facilitating cleaning. The bottom of the bowl is domed inward, so that should the wick fall through alight, any grease about it will quickly leave it and its burning can injure nothing on which it stands. The handle is attached to the bowl in such a way that any unusual pressure on the spring will not break it. These inventors have secured another patent wherein the invention provides a candlestick arranged that candles of any size may be firmly held in the socket of the candlestick, the candle easily raised as it burns down, enabling most of it to be burned.

MARKING-BOARD.—F. MOEHLE, Mason City, Iowa. In this instance the improvement relates to a device for facilitating marking and cutting glass, cardboard, and like articles. By means of the invention a sheet of glass, for example, may be readily marked to the desired form and dimensions and cut, or a sheet of cardboard may be similarly treated. For example, a mat for pictures may be marked and cut with any desired exterior and interior marginal form.

WATCH-GUARD.—W. F. MARTIN, New York, N. Y. This invention comprises a peculiarly-constructed guide intended to have the chain of the watch run through it, so that when a thief grasps the watch by the chain the watch will strike the guide and cannot be withdrawn, this arrangement not interfering, however, with the withdrawal of the watch by grasping the watch itself, in which case the chain will run idly through the guide.

WRITING-TABLET.—H. V. LOUGH, North Plainfield, N. J. The improvement has reference to those tablets which are formed of a number of semistiff sheets connected by a pivot or the like, so that each sheet may be written on and each conveniently referred to when desired. Ordinarily these tablets possess the disadvantage that the sheets or cards bear a fixed relation to each other—that is to say, their relative positions cannot be changed, so as, for example, to place the top sheet on the bottom, or vice versa.

NON-REFILLABLE BOTTLE. — M. M. KEARNEY, Scranton, Pa. Mr. Kearney's purpose is to provide a construction of bottle—particularly a construction of the neck of a bottle, stopper, and valve—which will prevent the possibility of refilling the bottle after the original contents have been poured out. The bottle in its entirety is simple and readily understandable to any person of ordinary intelligence.

MATCH-SAFE.—F. KING, New York, N. Y. The purpose in this case is to provide a safe or receptacle for matches so constructed that the matches can be removed singly only, one after the other, and to render such removal convenient and expeditious; also, to furnish exteriorly-operated means for insuring the matches being compactly and accurately fed to the outlet of the match safe.

OVERSHOE FOR HORSES.—J. E. HOFFMAN, New York, N. Y. The object in this case is to provide an overshoe of simple and inexpensive construction, that may be readily secured to the hoofs of horses or other draft animals and as easily removed therefrom and that when in place will effectually prevent the animal from slipping on icy or otherwise slippery pavement.

MUSICAL INSTRUMENT.—H. E. HIBSHMAN, Newark, N. J. In this patent the invention relates to reed instruments of the mouth-harmonica type, and its object is to provide a new and improved instrument which is simple and durable in construction and arranged to enable a person to properly execute a piece of music with the aid of a perforated music-sheet without requiring practice or knowledge of music.

DEVICE FOR EXHIBITING GOODS.—M. J. BEBB, Xenia, and E. G. EATON, Athens, Ohio. In this patent the invention is designed for suspending and displaying goods in stores or shops from the ceiling or any other fixed overhead support, and is particularly useful for displaying handkerchiefs, ribbons, hosiery, underwear, belts, neckwear, laces, shirt-waists, towels, etc., to the best possible advantage.

APPARATUS FOR FORMING CEMENT WATER-TANKS.—J. T. DONAHOO, Edgar, Neb. Hand labor is usually employed for forming tanks that are classified as apparatus for forming cement water-tanks; and it is the object of the inventor in this instance to provide an apparatus by which the work may be quickly facilitated and the tank thereby finished in a shorter time as well as in better form and also at the least cost.

DEVICE FOR FILLING FOUNTAIN-PENS.—L. FISK, Woodcliff, N. J. Provision is made in this invention for the easy filling of the pen by merely holding the mouth of the pen-reservoir to the spout of the instrument, and upon operating this instrument the ink is caused to flow into the pen-reservoir, all of this being effected without danger of spilling the ink, as repeated operations will not overflow the pen-reservoir.

SUSPENSORY-BANDAGE.—E. R. DRAKE, De Land, Fla. Mr. Drake's invention is an improvement in that class of suspensory bandages having a leg-band connecting the scrotal bag or pouch with the body-band. He has devised an improvement in such leg-bands and they may be worn with entire comfort, besides sliding more easily and being more durable than those constructed and arranged in the usual manner.

MIRROR DECORATING AND ILLUMINATING DEVICE.—SABELLA G. DOHERTY, New York, N. Y. The present invention refers to decorative lighting by electric lamps of the incandescent type; and the object is to provide an illuminated garland for use on mirrors, walls, interior and exterior balconies, and other objects and arranged to heighten the ornamental effect of the object as well as provide the desired illumination of the surrounding objects.

SCISSORS-HOLDER.—A. E. MOORE, Winnipeg, Canada. The prime object in this case is to provide means for holding the scissors within convenient reach of the user and by which the scissors may be held securely and readily engaged with or disengaged from the holder. To this end the invention comprises a body, gripping-fingers carried thereby and serving to hold the scissors, and a device at the rear of the body for attaching it to the clothing of the wearer.

FLASH-LIGHT ATTACHMENT FOR CAMERAS.—J. H. HAMMER, Marquette, Mich. The purpose in this case is to provide a device for direct connection with the shutter of a camera having means for supporting and exploding a flash-light charge and automatically and simultaneously operating the shutter, which may be brought about by direct connection with a cylinder operated at the time of the explosion by the flash-light material and connected by a tube with the shutter or by the automatic compression of a bulb in tube connection with the shutter.

RAPID-FIRE PISTOL.—W. B. KNOBLE, Tacoma, Wash. This pistol is specially designed for army and navy use. Officers object to the 38-caliber revolver's lack of shocking power. It being impossible with the length of barrel practicable in a pistol to obtain velocities with small bores sufficient to make up for lack of energy and stopping power, the only way to acquire the power lies in the use of a larger, heavier bullet having greater striking surface and propelled with a velocity unobtainable from a revolver. This powerful weapon does not exceed small bores in weight and size, and for use as a pocket arm is smaller, lighter, and more compact than magazine pistols of similar caliber.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Inquiry No. 4832.—For manufacturers of hand ore crushers.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 4833.—For a machine to turn wooden rolls of about 3½ to 3¾ inches in diameter and 36 inches long, also to bore 1¼-inch square hole through the rolls.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 4834.—For a thread-cutting die which will open when backing off so as not to strip the threads.

Sheet, bar, rod or wire, cut, formed, any shape. Metal Stamping Company, Niagara Falls, N. Y.

Inquiry No. 4835.—For makers of pliable iron, such as used for grilles, etc.

American inventions negotiated in Europe, Felix Hamburger, Equitable Building, Berlin, Germany.

Inquiry No. 4836.—For machinery for the manufacture of starch from the roots of the cassava plant.

Automobiles built to drawings and special work done promptly. The Garvin Machine Co., 149 Varick, cor. Spring Streets, New York.

Inquiry No. 4837.—For the address of the Union Parer and Corer Co., manufacturers of a tin potato peeler.

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The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 4840.—For manufacturers of gasoline lamps for country residences.

Empire Brass Works, 106 E. 129th Street, New York. N. Y., have exceptional facilities for manufacuring any article requiring machine shop and plating room.

Inquiry No. 4841.—For manufacturers of dredges and ditching machinery.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 4842.—For makers of small induction coils outfits, etc., for the mail order business.

Contract manufacturers of hardware specialties, machinery, stampings, dies, tools, etc. Excellent marketing connections. Edmonds-Metzel Mfg. Co., Chicago.

Inquiry No. 4843.—For molds for molding articles, such as pails, etc.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 4844.—For manufacturers of tobacco planters.

Inquiry No. 4845.—For makers of long distance telephones.

Inquiry No. 4846.—For outfits for bath purposes and Turkish baths.

Inquiry No. 4847.—For dealers in trial test sets for opticians.

Inquiry No. 4848.—For a machine for drilling two holes at once in a joist, used by electricians for inside wiring.

Inquiry No. 4849.—For parties engaged in the development of electrical inventions.

Inquiry No. 4850.—For manufacturers or dealers in slot or coin vending or amusement machines.

Inquiry No. 4851.—For manufacturers of gun tools and locksmith materials.

Inquiry No. 4852.—For dealers in sewing machine repairs.

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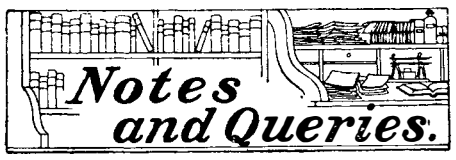

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Minerals sent for examination should be distinctly marked or labeled.

(9232) G. B. E. asks: Will you kindly inform me if the current going over a telephone line when a person speaks into a battery transmitter is a direct or an alternating one? A. With an induction coil, the transmitting telephone being in the primary circuit, the current in the secondary is alternating, since an increase of the lines of force takes place when the diaphragm is approaching the magnet of the telephone transmitter, and a decrease takes place while the diaphragm is receding from the magnets.

(9233) C. D. R. M. writes: Since air freezes at about 310 degrees below zero, and since the temperature falls one degree for every 333 feet of ascent from the earth, or about 15¾ degrees to the mile, it is clear that air must be frozen at less than 20 miles ascent from the earth, and if frozen, it must fall, and friction, heat, and electric phenomena must result. If it is said that 800 cubic feet of air must be compressed into one foot of liquid air, I reply more than 1,700 feet of vapor must be condensed into one cubic foot of rain water, but nature has an easy way of doing it. If it is said, again, that the air is far too rare to be frozen at such a height, I reply, if this were true in general, which is not proven, yet with the wind blowing 50 to 70 miles an hour, as it sweeps upward from the earth, it must carry plenty of common air up into those unexplored regions. A. The constituents of the atmosphere are all of them unsaturated gases at the surface of the earth. As their density is produced by gravity, it follows that they are less saturated at a higher altitude than they are at any lower place, and therefore farther from the point of liquefaction. The contraction produced by cooling is less than that produced by the pressure of gravity. There is, so far as we can see, no reason to suppose that there is liquid air in the higher layers of the atmosphere. It would seem that it should be detected by optical methods, by its effect upon the light, if it were present anywhere in the atmosphere.

(9234) E. P. J. writes: Please give in your inquiry column the number of pounds of lifting power exerted by 10,000 (or 100,000) cubic feet of pure hydrogen gas. Great interest is now manifested by the general public in the possibilities of aerial navigation. There seems, however, to be considerable disagreement in regard to the facts pertaining to the subject. I recently submitted to two supposed scientists the question as to what the lifting power of the hydrogen gas contained in a cylinder 100 feet long and 40 feet in diameter would be, and one gave the answer as 3,000 pounds, and the other 8,000 pounds. Of course, one of them must be wrong, and perhaps both of them. I would be glad to know what your estimate would be. A. The usual allowance for the lifting power of hydrogen gas is 70 pounds per 1,000 cubic feet at the normal pressure of the atmosphere. A balloon 100 feet long and 40 feet in diameter will contain 125,000 cubic feet, and will therefore lift about 8,750 pounds at the start. This includes all weights, bag, car, ballast, aeronauts, food, etc. The answer 3,000 may allow for all these and leave the excess of lifting power. The answer 8,000 evidently is a round number, and includes all weights.

(9235) R. J. L. says: I want to ask you the following question: How to demagnetize a watch? I am working in an electric light plant, and recently my watch became magnetized. Our dynamos are 110-volt, General Electric machines. I have worked around them, and have been leaning on the frame and had the watch close to the field coils many times, but have never had the watch affected before, so I am not sure whether the machines or having the watch close to pieces of magnetized iron is responsible for the trouble. I see jewelers use a coil of wire with a hole in the center large enough to admit a watch, which is connected to an alternating current, and the watch is dropped in the coil and pulled out and it is demagnetized. Now our machines are direct current, and I would like to know if it is possible to do it with our machines, and what the outfit would consist of. I have been taking your paper for about three years, and have never noticed any information of that kind in your question column. A. A watch may be demagnetized by a direct-current dynamo by hanging it by a string and twisting the string so as to rotate the watch rapidly, near to the pole of a strong magnet. While it is whirling, gradually remove it from the neighborhood of the magnet. The method you describe with an alternating current is far more effective and reliable. You cannot bring the watch into the positions you describe without magnetizing it.

(9236) J. M. M. asks: Will you please to state the approximate weight of water, and also the weight of the iron jackets required to cool a 60-horsepower automobile motor? A. The amount of water required for cooling automobile motors depends upon the tank air surface that can be obtained in location and design of the automobile parts. In the best designs of the present date, about two gallons of water per horse power is used with a rib pipe cooling tank weighing about six pounds per horse power.

(9237) C. E. B. asks: 1. Is it at present practicable to run an automobile with compressed air? A. The operation of automobiles by compressed air has not been a success. It requires expensive machinery to compress the air, and the system is considered too limited in a single run for its successful operation. 2. Could I make a working model of tin? A. You can make a tin model of an invention, but not a proper working model. 3. Have any large corporations experimented with compressed air for a motor power for automobiles, street cars, etc.? A. Compressed air is in use for motive power for railways and street cars, factory tramways, and many other uses requiring transmission of power to considerable distances. 4. Would five or six hundred dollars be enough to perfect it? A. Five or six hundred dollars will be of little account in perfecting a compressed-air plant, on which millions have been spent with but indifferent success.

NEW BOOKS, ETC.

DIE ASSANIERUNG VON WIEN. Bearbeitet von Paul Kortz, H. Schneider, H. Goldemund, Dr. med. Alois Grünberg und Dr. med. Alfred Freund. Herausgegeben von Dr. Th. Weyl. Mit einem Vorwort von Franz Berger und Dr. med. A. Löffler. Mit 76 Textfiguren und 14 Tafeln. Leipzig: Verlag von Wilhelm Engelmann. 1902. Pp. 194. Price $4.

DIE ASSANIERUNG VON ZÜRICH. Bearbeitet von Bühler, Dr. Alf. Bertschinger, J. Fluck, H. Peter, G. Fr. Rothpletz, H. Schatzmann, V. Wenner, E. Wüst. Herausgegeben von Dr. Th. Weyl. Mit einem Vorwort von Dr. Th. Weyl. Mit 41 Textfiguren und 10 Tafeln. Leipzig: Verlag von Wilhelm Engelmann. 1903. Pp. 120. Price $4.

The publication of monographs on the sanitary systems of the larger European cities will doubtless be welcomed by those who have the interests of municipal engineering at all at heart. Data which have hitherto not been available, either because they have not been published, or because they are to be found only in widely-scattered periodical literature, are here collected for practical utilization; municipal officers are given the opportunity of studying with the greatest convenience the improvements which have been made in the sanitation of the leading cities of the world.

The first of these monographs, dealing with the sanitation of Vienna, shows how difficult a task was encountered in that city by engineers. With municipal traditions extending back for hundreds of years, it was no light task to undertake a complete renovation. It is, therefore, not to be wondered at that Vienna was transformed into a modern metropolis only after it had outgrown its city walls, which happened about forty years ago. Even in that brief space of time the city has not been quite able to counterbalance the losses which its previous tardiness had entailed; still, a city of its size more than deserves the attention of the municipal engineer.

The city of Zürich, which forms the subject of the second monograph, has progressed far more rapidly in the same period. The town has been provided with a good supply of drinking water. An admirable drainage system has been installed. Large sums of money have been appropriated for the extension of the water system and for the building of broad streets. The administration of the health board of the town is admirable. Unfortunately, the rather defective vital statistics of the town render it impossible to prove the effect which these sanitary conditions must have had upon the health of the community.

TELEPHONY. Part III. The Construction of Cable Plant. By Arthur Vaughan Abbott, C.E. New York: McGraw Publishing Company. 1903. 12mo. Pp. 142. Price $1.50.

The appearance of the third part of this excellent work will be welcome to electrical engineers. The subject is a very important one, and as far as our knowledge of the subject goes, is well treated. The contract and specifications for cable construction occupies more than half the book. We have already called attention to the very lucid nature of the contracts outlined in the previous volumes. It would be wise if every industry had similar contracts adapted to its own peculiar line of business.

HANDBUCH DER INGENIEURWISSENSCHAFTEN. Zweiter Band. Der Brückenbau Sechste Abteilung: Eiserne Brückenpfeiler, Ausführung und Unterhaltung der eisernen Brücken. Bearbeitet von G. Mantel und W. Hinrichs. Herausgegeben von Th. Landsberg, Dr. Th. Schäffer, und Ed. Sonne. Dritte vermehrte Auflage. Mit 275 Textfiguren, Sachregister und 13 lithographierten Tafeln. Leipzig: Verlag von Wilhelm Engelmann. 1903. Pp. 371.

The second volume of this admirable handbook of civil engineering (which may be regarded more as an exhaustive treatise than as a handbook) deals with certain important questions in bridge construction, notably iron bridge piers, and the construction and maintenance of iron bridges. Particularly in the chapter on Iron Piers is to be noted an excellent theoretical discussion as well as a description of practical improvements which have been made within the last decade. The late W. Hinrichs prepared the chapter on Bridge Maintenance with praiseworthy thoroughness.

YOUNG IVY ON OLD WALLS. A Book of Verses. By H. Arthur Powell. Boston: Richard G. Badger. 1903. Pp. 57.

Mr. Powell has here collected several poems which have appeared in the popular magazines of the day, and has added thereto verses which have hitherto not been published. Although it hardly falls within our province to pass upon the poetical merits of his verses, to us it seems that he is at his best in his descriptions of nature. Particularly happy seem to us the poems entitled "After the Rain" and the "Mummers."

LIGHT WAVES AND THEIR USES. By Albert A. Michelson. Chicago: The University of Chicago Press. 1903. 8vo. Pp. 164. Price $2.

This book contains a course of eight lectures delivered before the Lowell Institute at Boston in the year 1899. In these lectures the results of the investigations with which the author has been engaged for the last twenty years are presented in language as free from technicality as possible. They contain much information about light waves which is to be found only in scientific periodicals. The subject while of great scientific interest is presented in such simple form that comparatively little training is needed to enable one to comprehend the essential facts and fundamental principles involved. The three colored plates are admirably executed.

THE WELLCOME PHYSIOLOGICAL LABORATORIES. By Walter Dawson, M.A., M.D. Brockwell Hall, Herne Hill, London, S. C., England. 12mo. Pp. 36.

It was for the purpose of participating in the inevitable advances of scientific thought and discovery, which concern not merely institutions and individual scientific workers, but upon which the progress and intellectual status of mankind so largely depend, that the Wellcome Physiological Laboratories were founded. Mr. Wellcome, who established the laboratories, while a manufacturer of drugs, keeps this institution entirely separate and distinct from his business and under independent direction. The work which these laboratories are doing is very valuable.

THE MECHANICAL ENGINEER'S POCKET-BOOK OF TABLES, FORMULÆ, RULES, AND DATA. By D. K. Clark, M. I., C. E. New York: D. Van Nostrand Company. 1903. 18mo. Pp. 692. Price $3.

The fifth edition of Clark's Pocket-Book will be warmly welcomed by engineers. It has already stood the test of time, and has proved itself to be an accurate and useful book. It would be almost useless to give any account of its contents; as far as this goes, it resembles other well-known pocket-books. It deals with mathematics, mensuration, metals, alloys, strength of materials, heat, fuels, steam, steam engines, boilers, railways, steamships, gas, compressed air, windmills, water powers, electrical engineering, and allied subjects.

FÜNFUNDZWANZIG JAHRE IM DIENSTE DER SACCHARIN-INDUSTRIE UNTER BERUCKSICHTIGUNG DER HEUTIGEN SACCHARIN-GESETZGEBUNG. Votrag gehalten von Dr. Constantin Fahlberg vor dem V. Internationalen Kongress für angewandte Chemie, Reichstagsgebäude. Berlin. 1903. Pp. 38.

GOVERNORS AND GOVERNING MECHANISM. By H. R. Hall. Manchester, England: The Technical Publishing Company, Ltd. 1903. 16mo. Pp. 119, 76 illustrations. Price $1.

The subject of the governing of engines by mechanical means is a most important one, and the writer has done a distinct service to mechanical engineering in the preparation of the present lucid volume, which is admirably illustrated by engravings and folding plates. Some of the types of governors shown are most novel, and are not used at all in American practice.

INDEX OF INVENTIONS

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AND EACH BEARING THAT DATE

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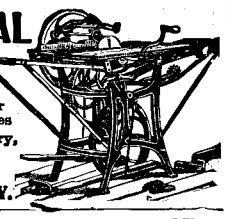

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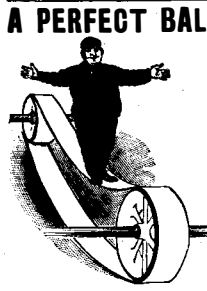

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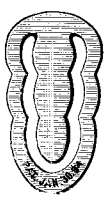

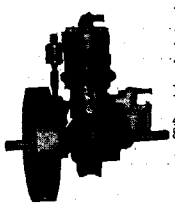

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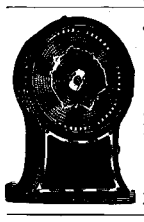

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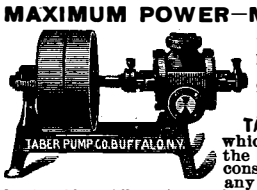

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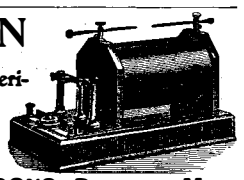

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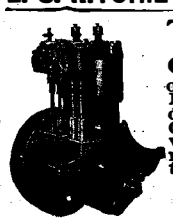

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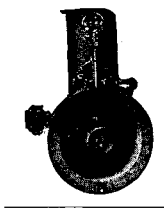

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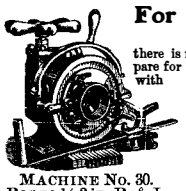

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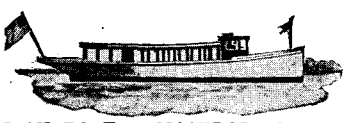

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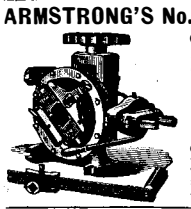

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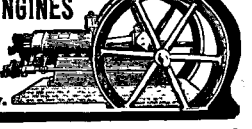

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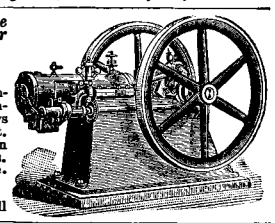

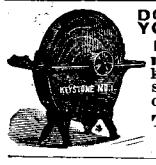

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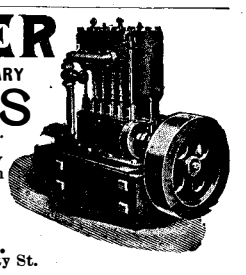

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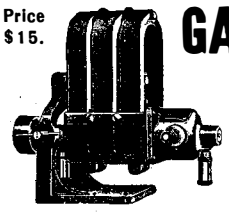

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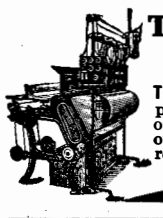

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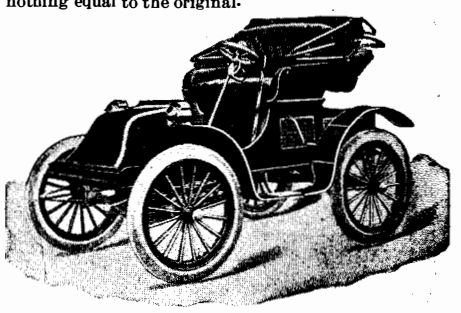

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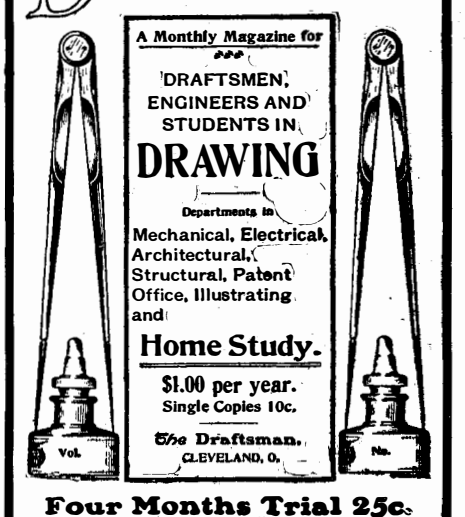

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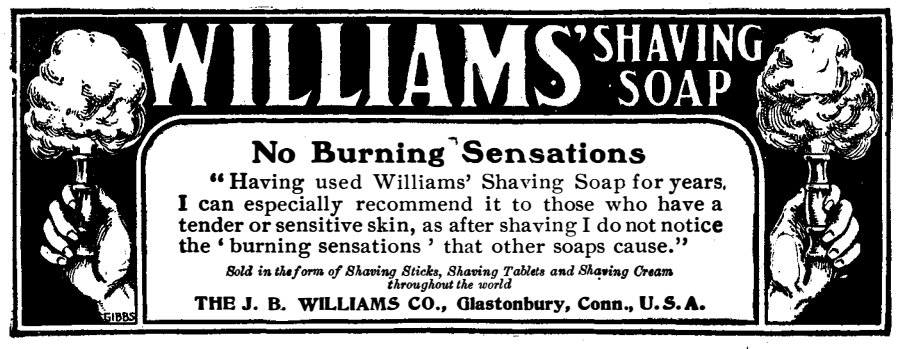
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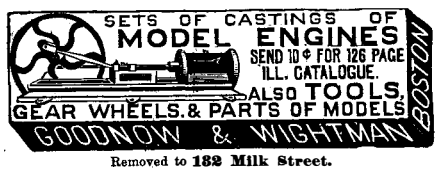

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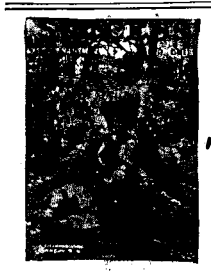

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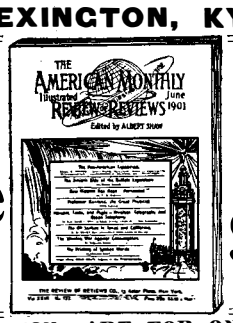

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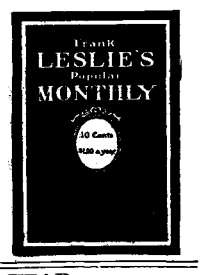

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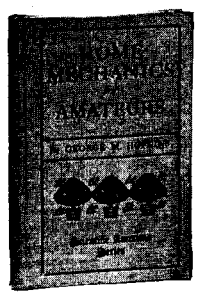

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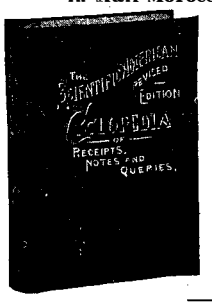

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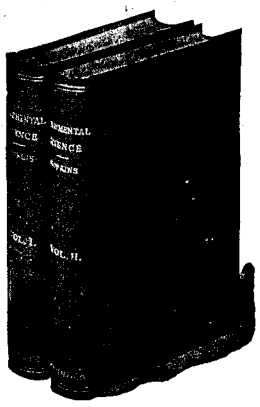

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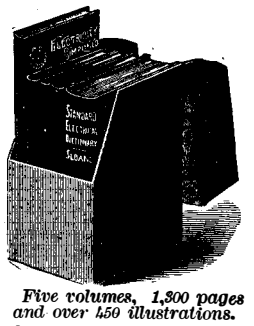

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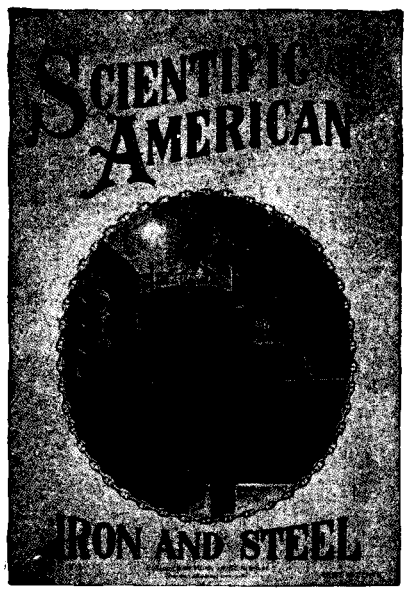

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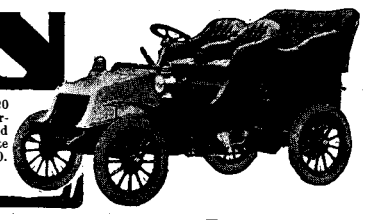

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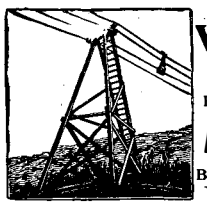

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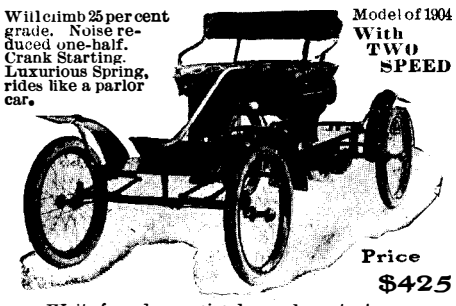

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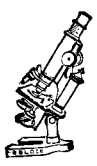

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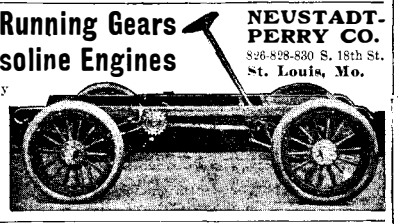

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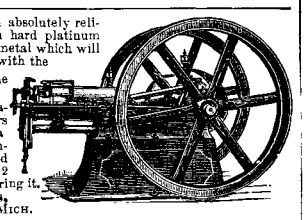

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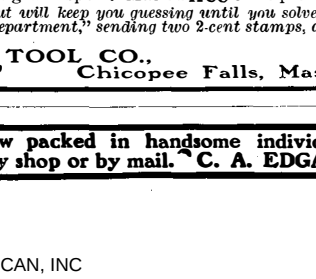

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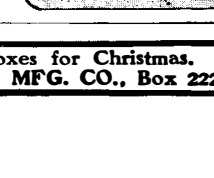

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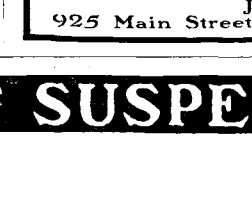

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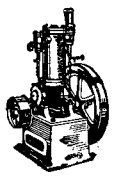

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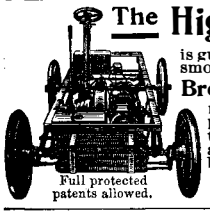

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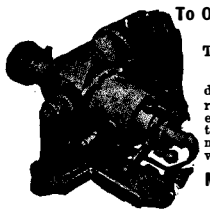

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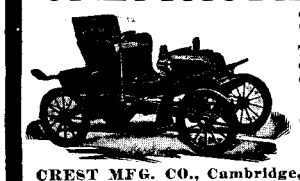

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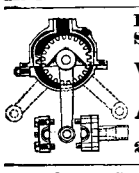

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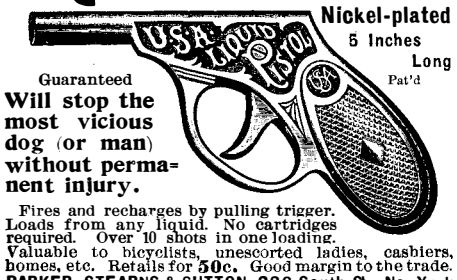

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